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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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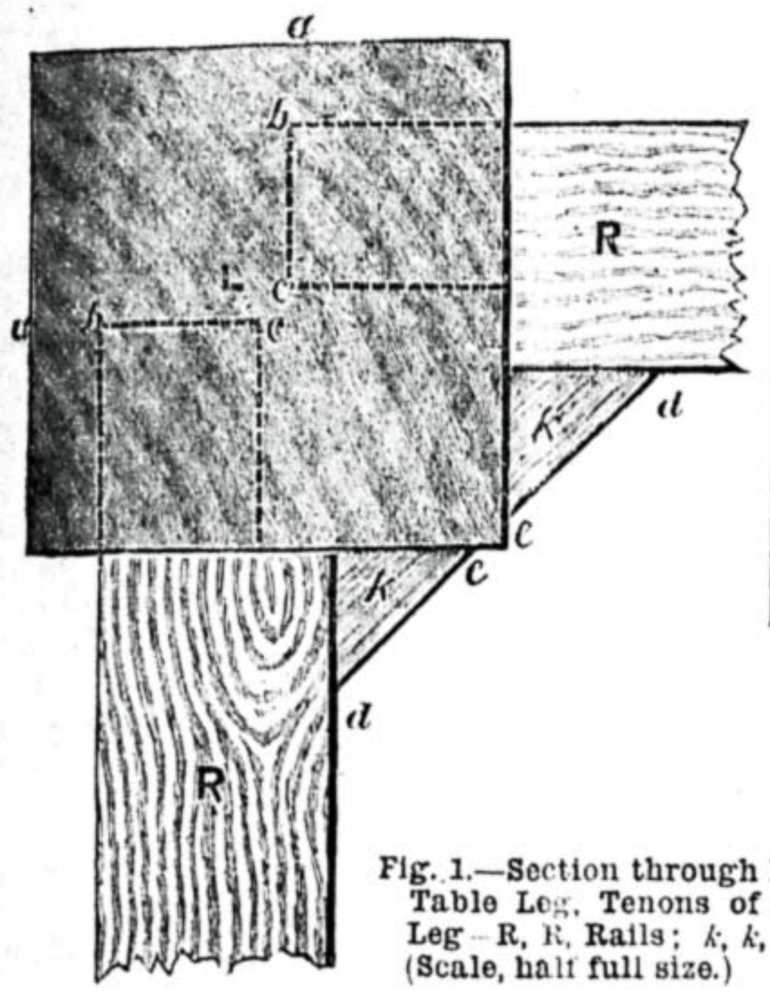

Fig. 1.—Section through Mortices of Table Leg, Tenons of Rails, and Leg—R, R, Rails; *k*, *k*, Blockings. (Scale, half full size.)

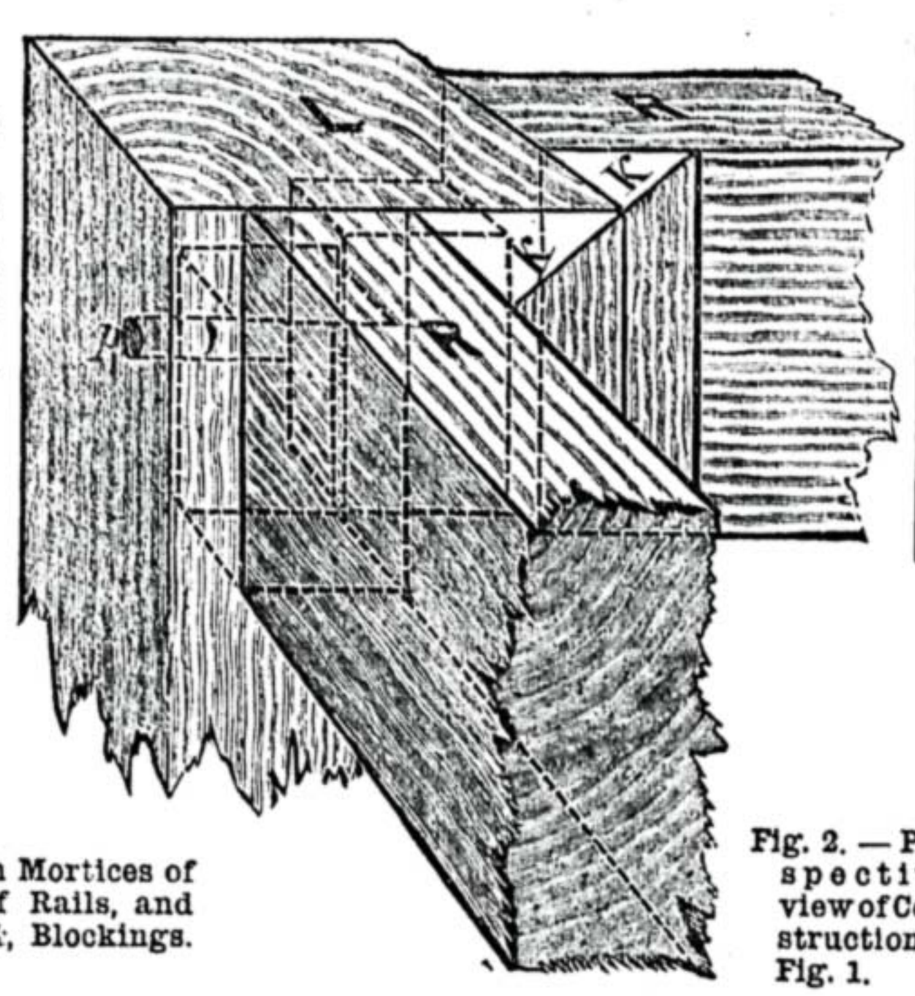

Fig. 2.—Perspective view of Construction in Fig. 1.

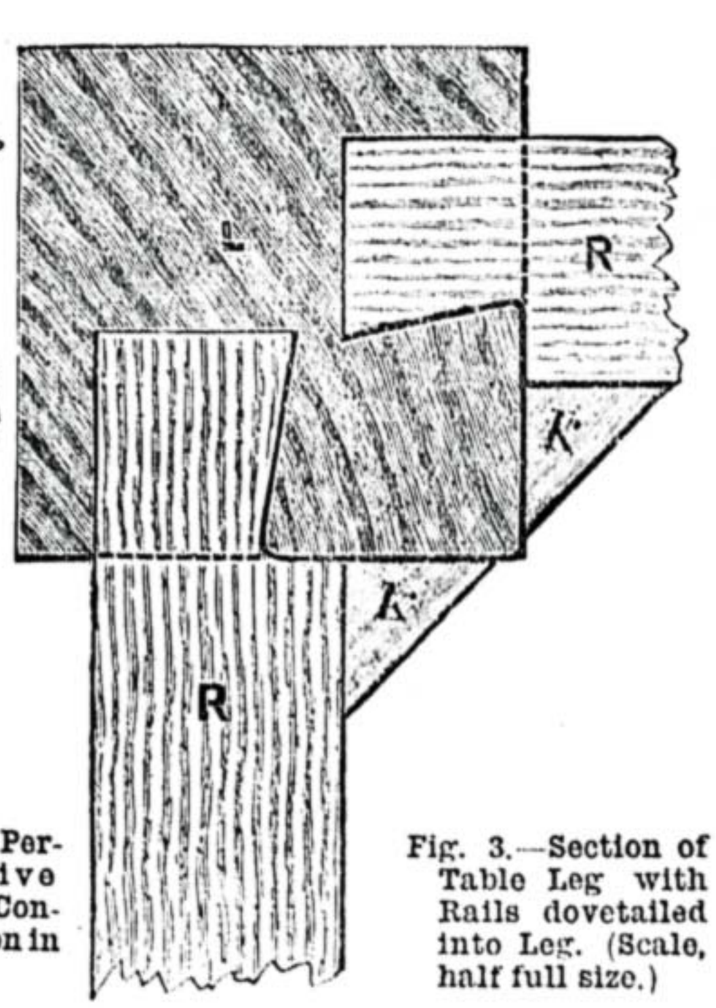

Fig. 3.—Section of Table Leg with Rails dovetailed into Leg. (Scale, half full size.)

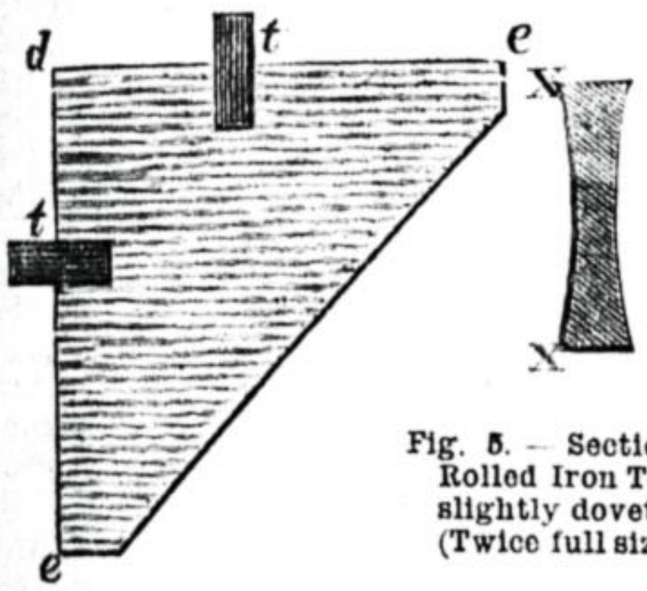

Fig. 4.—Section of Blocking (*k*, Figs. 1, 2), showing Tongues of Wood or Iron at *t*, *t*, for extra hold. (Full size.)

Fig. 5.—Section of Rolled Iron Tongue slightly dovetailed. (Twice full size.)

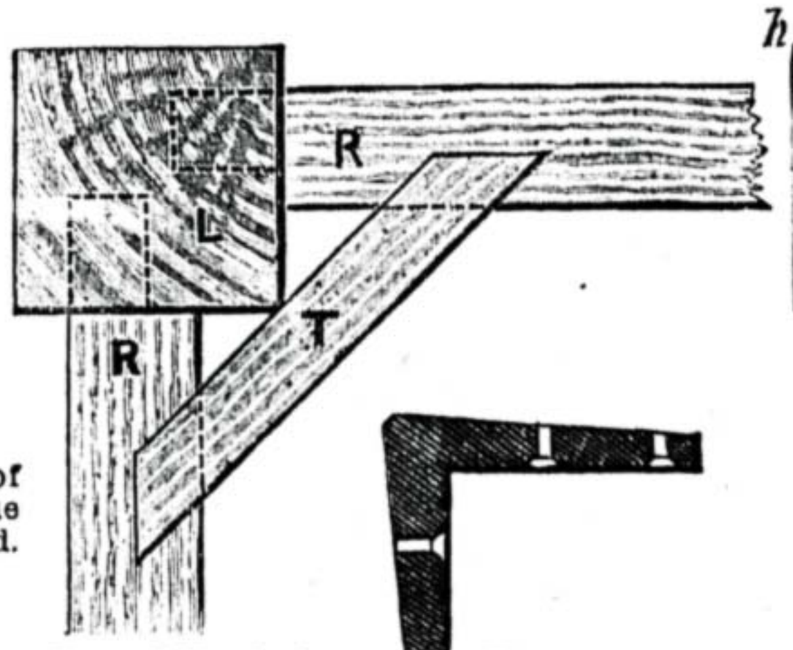

Fig. 6.—Plan of Head of Table Leg and Rails, showing Tie, T. (Quarter size.)

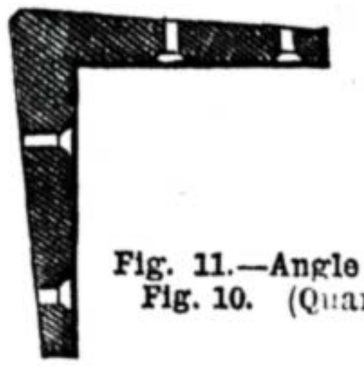

Fig. 11.—Angle Bracket as in Fig. 10. (Quarter full size.)

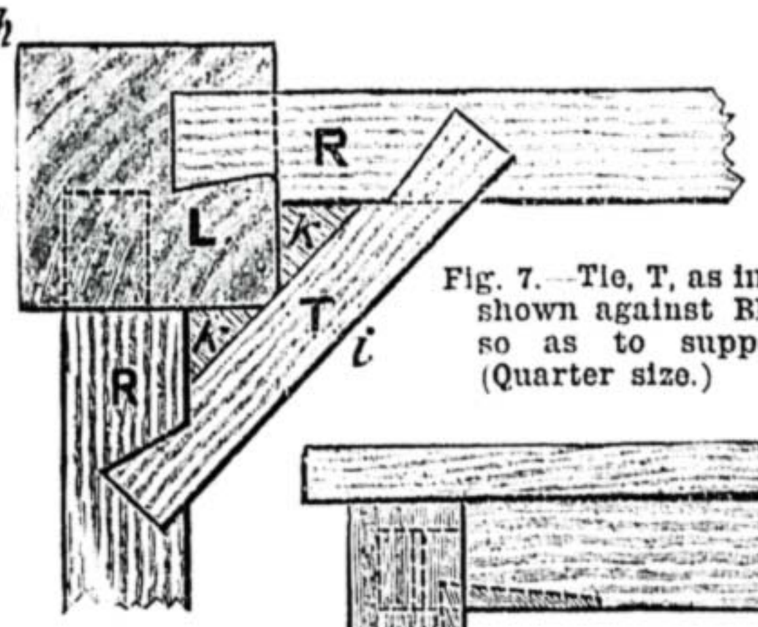

Fig. 7.—Tie, T, as in Fig. 6, shown against Blocking so as to support it. (Quarter size.)

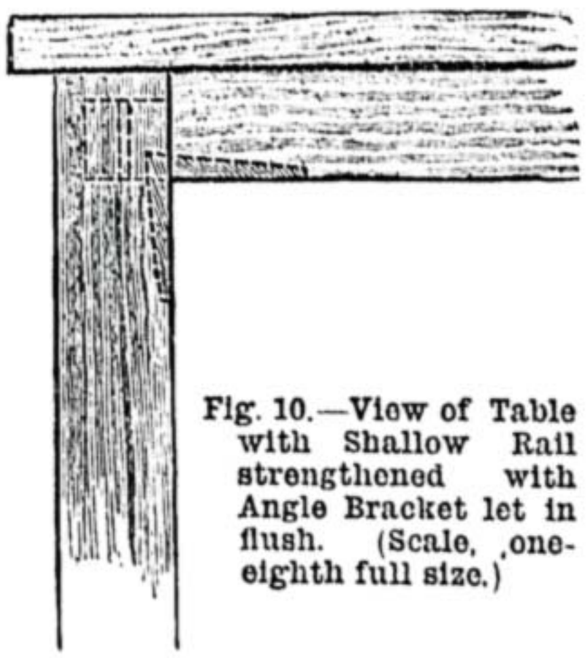

Fig. 10.—View of Table with Shallow Rail strengthened with Angle Bracket let in flush. (Scale, one-eighth full size.)

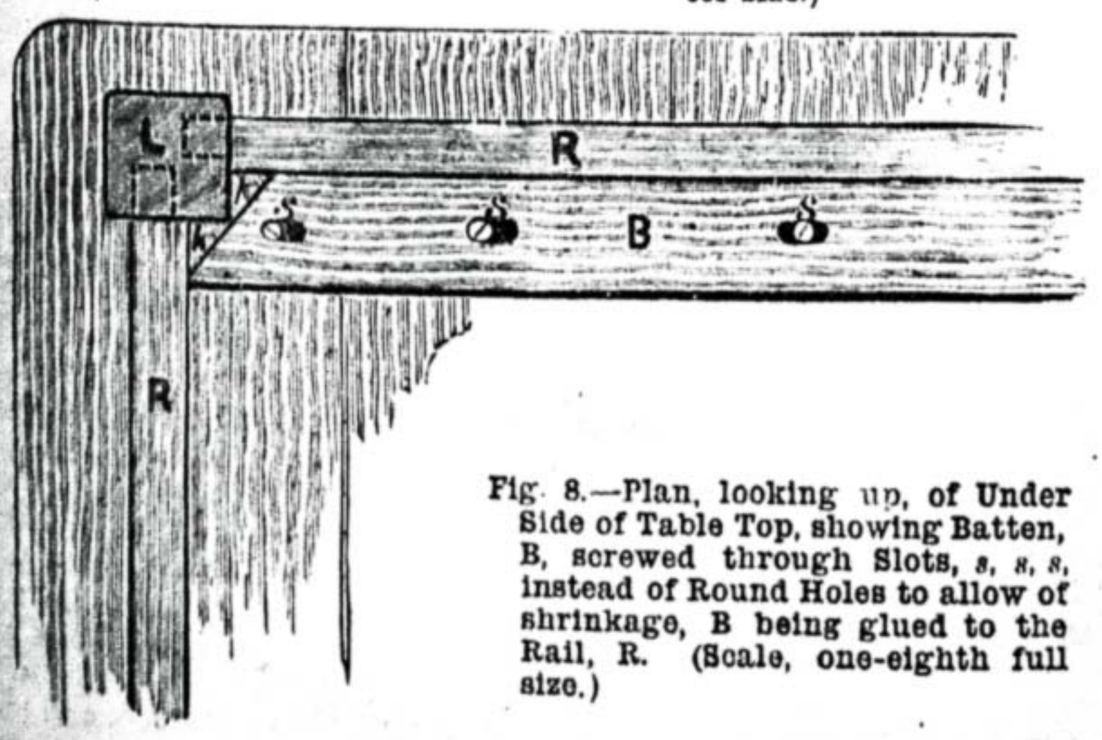

Fig. 8.—Plan, looking up, of Under Side of Table Top, showing Batten, B, screwed through Slots, *s*, *s*, *s*, instead of Round Holes to allow of shrinkage, B being glued to the Rail, R. (Scale, one-eighth full size.)

Fig. 12.—Sketch showing method of fixing Back and Side Rails of Chair to Back Leg. (Scale, quarter full size.)

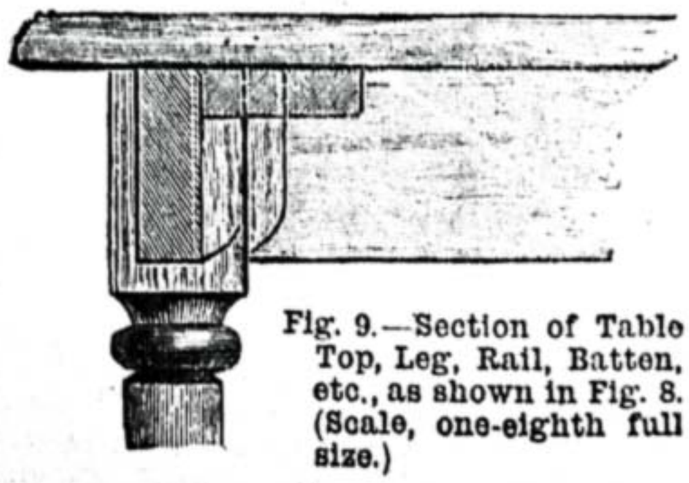

Fig. 9.—Section of Table Top, Leg, Rail, Batten, etc., as shown in Fig. 8. (Scale, one-eighth full size.)

CONSTRUCTIVE STRENGTH IN WOODWORK.

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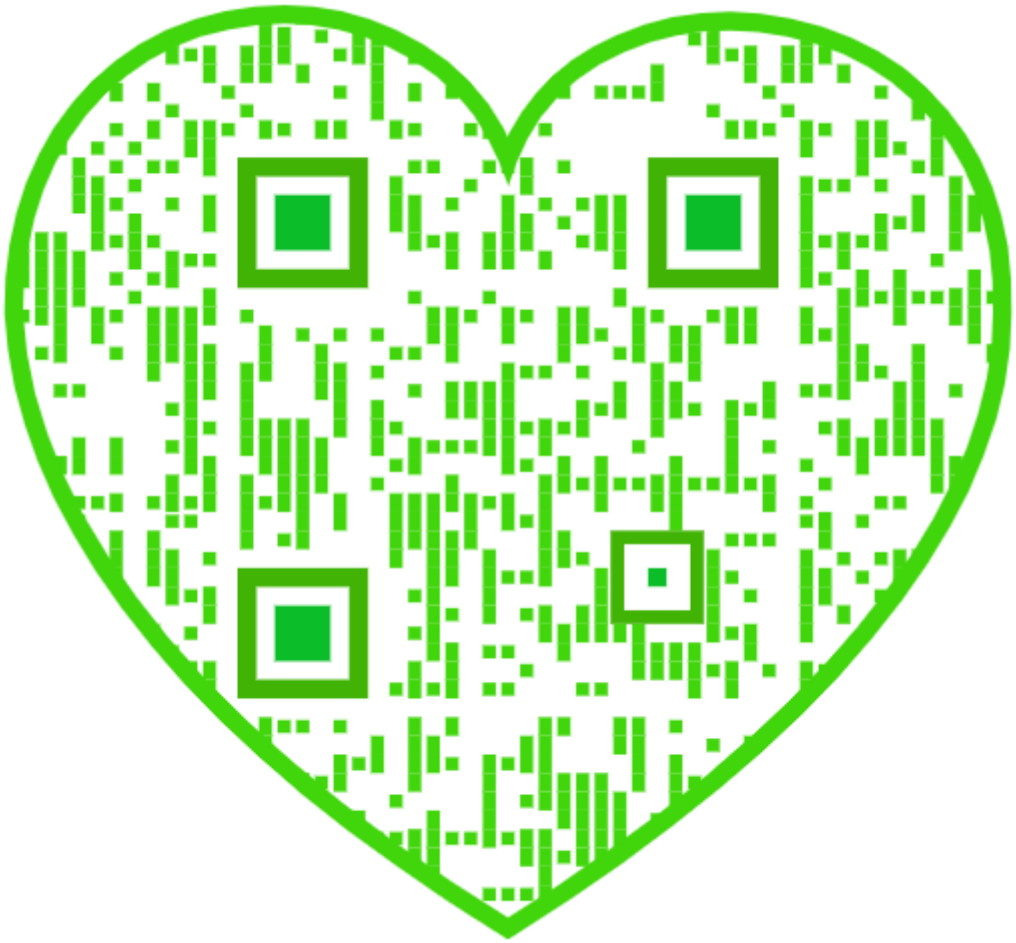

CONSTRUCTIVE STRENGTH IN WOODWORK.

BY JOHN WHITFIELD HARLAND.

In my two previous articles it has been my endeavour to show that whilst the tendency of workmen is naturally to work on in the old grooves and follow on in the way they were taught to do during their apprenticeship on the same old lines, that it is just worth while to think out, each for himself, the reason which dictates the method used, and to judge whether it really effects the purpose or not, and if not, or if only partially effective, how it can be improved upon in practice, either by economy of time or material, or both, or by obtaining, even at the sacrifice of one or both, extra strength of construction, thus enhancing the value and durability. I have met often during my travels abroad and experience at home with thorough workmen—those who have taken pride in the thought that when they were dead and gone the work of their hands would long survive them. I do not say that there are many who feel this—would that there were more—but these exceptions might have been more numerous if workmen took more thought about means, modes, and methods, and did not go in so much for piece-work and systematic overtime. I would fain see resuscitated that noble spirit of pride which animated the old guilds, both in England and Germany, when the high ambition to produce a masterpiece worthy of each craft, lightened the drudgery of apprenticeship, and sustained the fainting courage, and buoyed up the hope of the "journeyman" on his travels in search of new experiences amid hardship and toil, still learning and working for the end in view—the qualifying to become a master, not so much of others, as of his craft and of himself. This was the age of chivalry, so to speak—the chivalry of labour, when men *loved* their work for its own sake rather than for the coin it brought them. It has been said, most truly, that the boundary line between Work and Art is love. Work that is done under the influence of love of work is already Art.

I now come to the consideration of constructive strength in structures involving the third dimension, which, for clearness' sake, I will call *cubic* framing, the simplest form of which is a box, which, though not, strictly speaking, framed together, usually is an instance of the third dimension of constructive strength. It is easy to see that a casket—*i.e.*, a box with panelled ends, sides, and lid, all of which must be framed together separately—can be afterwards framed together in one or more ways so as to be strong. Again, a cupboard, a sideboard, or a chiffonnier, with the front made into a door, or pair of doors, is an example of cubic framing. Then we come to the familiar table and the ordinary carpenter's bench, in both of which we have to decide how to obtain strength and rigidity, with the least labour and the least waste of material. Here, again, the characteristics of wood must be borne in mind—viz., its grain, and consequent liability to split, or to shrink in one direction. Instead of making a simple frame in any of the ways shown in my second article (see WORK No. 76, p. 383), in constructing a table, we no longer frame sides and ends together, but into a third member (*i.e.*, the legs), destined to bear not only weight acting downward, but very complicated side thrusts in every lateral direction. As the bottoms of the legs rest upon the floor, and the strains occur at their upper extremity, a very great leverage acts in favour of breaking the joints of the legs to the framing.

Fig. 1 shows section of leg L of table morticed with rails (end and side) R, R, tenoned into it, which is the usual way. Note that in order to avoid weakening the leg L the rails are reduced on their inner sides so as to leave shoulders for them inside, and keep the mortices separate instead of running one into the other, thus eating away the core of the leg, which would be bad construction. Thus the points *c*, *c*, which are the closest points of the two mortices, have sufficient of the wood of the leg L left between them to permit of coherence. Care should therefore be taken in morticing not to cut the mortices any deeper than just to clear the tenon ends, which ought to be made to touch the bottom of mortice, smoothed carefully to one exact depth all over. I have shown tenons of the rounded form at shoulder spoken of in previous article. Note that the proportions shown are $a\,b = c\,c$, $b\,c$ = twice $a\,b$, $d\,e = b\,c$, and therefore $a\,b + b\,c = d\,e$ plus the depth of shoulder. Fig. 2 is a perspective sketch of Fig. 1, dotted lines showing tenons, etc., and lettered to correspond with above description, and with Fig. 1.

Instead of tenoning the rails into mortices in the leg L, they may be dovetailed as shown in Fig. 3, a method which, on the whole, I prefer, for the following reasons:—

A dovetail is not so likely to *draw* as a tenon, even when pinned as at *p* (see Fig. 2). The dovetail can be made the full depth of the rail, whilst the tenon must be at least three-quarters of an inch lower down the leg than the top of the rail to leave any wood at all above the mortice; and thirdly, the dovetail gives better facilities for good fitting, requires no cramping up when gluing, and is more easily kept square. For amateurs, greater ease of construction will be found in the dovetail than the mortice, which, of course, is not through, and is therefore not so easy to mortice perfectly square. In order to further strengthen the junction between rails and leg, what is termed "blocking" is resorted to. A reference to Figs. 1 and 3 will show that at *k*, *k*, a three-cornered piece of wood is glued into the angle formed by the inner parts of the leg and the rail, to stiffen the framing and assist the leg to resist strains and side-thrusts. Here let me interpolate a very simple and, I believe, entirely new blocking, useful for staircases and for every other purpose for which blocking is available. My idea is that if the glue should perish some other form of attachment ought to be provided, and the very simplest form seems to be to cut a "saw-gate"—*i.e.*, a groove with the saw in both surfaces; and care being taken that they are opposite, drive into both, when gluing, a tongue, either of wood or iron (hoop-iron preferably), as shown in section Fig. 4, at *t*, *t*. This would not only hold up the block *k* to its work, but would exclude the air entirely from those surfaces inside the tongues—viz., *d t*, *d t*, even if the glue perished on the surfaces *t e*, *t e*. In large contacts the tongues might be made of hoop-iron, rolled to the section shown in Fig. 5, which would amount to a double dovetail, the saw-gates being made wider inside by inclining the saw both ways a little, to allow the extra thickness of metal at *x x* to be driven in. In making a single article, nails or screws should be used in blocking, as glue, in our variable temperature, is unreliable if used alone.

Perhaps the form of tie (T) shown in Fig. 6, used as it may be either alone or in conjunction with blocking, ought to be more employed in good construction than it is. If used as an adjunct to blocking, it might be fitted so accurately (see Fig. 7) as to maintain the blocking in place, at any rate at the top, and should be glued to it.

In billiard tables, where perfect rigidity is a *sine quâ non*, not only are the rails tenoned into mortices in the legs, but bed-screws are also inserted to pull up the tenons into their places, between the double tenons. I hope shortly to give full instructions for constructing billiard tables in WORK, many workmen and amateurs expressing a desire for this information, especially as I regard the training to eye and hand afforded by this pastime, in the matter of angles of incidence and projection, as most valuable, when this subject of uniting firmly rails to legs will be further treated of.

Many years ago a Manchester chair-maker, a Mr. Reilly, patented a tie, similar to T, Fig. 7, but with a screw-bolt put through from *h* to *i*, to hold the back leg firmly to the seat rails; and as I happen to know that the carrier's monthly account from Liverpool to Manchester for timber, mahogany chiefly, was from £30 to £40, his patent must have been fairly patronised. It *sometimes* pays to try to improve upon ordinary methods in constructive strength. It must not be lost sight of, that when the rails of a table are framed to the legs in either of the ways shown above, that the fastening of the top down to them may be made a very important factor in maintaining them square and rigid, by screwing or nailing the top down to them; but there is also another consideration to be taken to account, and that is the probable shrinkage in *width* of the top, which, especially if jointed together, tends to break and open such joints; besides the minor consideration of appearance being sacrificed to some extent, by showing nail or screw-heads in the top. This is by far the most difficult problem in this connection. We require the support the top affords in strengthening the framing below, and yet, if it shrinks, it will either split or a joint will open, even if made of the driest and best-seasoned timber. If, as is frequently done, the top is "buttoned" down, as it is called, it shrinks without splitting, but it affords little or no support to the frame. Perhaps the best job is to joint up the top first, lay it in its place, and mark from below where it lies upon the end rails. Then get out and plane up square and true, two battens. Take off the top, taking care that the battens are exactly the length of the rails, and fix them with screws to the under side of the top, *not* through round holes, but through oval ones or slots, enabling the wood to shrink naturally. If properly fitted, these battens, which cannot shrink endways, may be skew-nailed, glued, or screwed against the insides of the end rails, and will maintain the rigidity and squareness of the top frame against all strains. This is shown in Figs. 8 and 9, the one, a view looking under table top, the other, a section through both top and rail, showing good fixing for batten against both. Again, where there is either no room for, or the design does not permit of, a rail deep enough to stand the various strains on the leg, and no bottom rail can be used, iron angle brackets let in and screwed to both leg and rail may be very advantageously resorted to. (See Fig. 10 of the form shown larger in Fig. 11, where the knee, known to be the weakest point, is made doubly thick and let further in, the inside being square and the outside bevelled off.)

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The above remarks, specially applicable to tables, which furnish the most evident examples of side strains, are also to a lesser extent to be borne in mind in reference to cabinets, caskets, mantels, and indeed every other form of cubic framing, in which, however, greater strength and support are usually obtainable by using cross-rails, or plinths, or other means of connecting the bottom of the legs as well as the top. I recommend iron or even steel angle brackets, as Fig. 11, also for repairing chairs that have been rocked back on their hind legs, and got consequently very shaky in the back tenons and mortices. It is astonishing to find so many otherwise sensible and even well-educated people delight in thus ruining chairs by rocking to and fro on the back legs, whilst the front legs are raised from the floor, and who never seem to reflect what a fearful compound strain they are exerting on a poor tenon, perhaps only 1 in. × $\frac{3}{8}$ in., going into the mortice $\frac{3}{4}$ in. at most! The rail 16 in. long, and the leg from seat to floor another 16 or 17 in., form a bent lever equal to a straight one of 32 or 33 in., at the end of which the whole weight of a man is acting to break it, in or near the middle! Is there any wonder that chairs give way under such treatment? But as people will go on, and do go on, doing such stupid things, the workman should, with this knowledge of the sort of strain his chairs will be probably subjected to, endeavour to gain all the strength possible at this point. I recommend, after the chair is framed together, angle blocking of the form shown in Fig. 12, secured with good glue and screws to back and side rails, and by means of a $\frac{1}{4}$ in. thick coach-screw held firmly to the back leg, which should have a short chamfer, as shown, accurately fitted to the inside face of the blocking, as a bearing to pull it up to with the coach-screw. By this means great extra strength is given, and in the event of the leg ever working loose, a part of a turn of the coach-screw would effectually tighten it up again.

Within the scope of these articles it would be quite impossible to allude to all the various forms of cubic framing, but I think that the types above chosen will be sufficient guide for all other cases, which they govern to a large extent; and if the application should prove difficult in any particular case, I will give such further explanation as may be requisite in "Shop." I may also point out that in tables the end rails may be dovetailed as in Fig. 3, whilst the side rails are morticed and tenoned as in Fig. 1, which is sometimes done in very long narrow tables when the tenons go right through the leg and are wedged up.

PARAFFIN LAMPS.

BY THOMASO.

DEFECTS IN PARAFFIN LAMPS—BURNERS—RESERVOIRS—MY FIRST LAMP—USEFUL READING LAMP—WHERE TO BUY BURNERS—MATERIALS.

OIL has many advantages over gas as an illuminant, and this, I think, people are beginning to find out, if the number of lamps seen on every side affords any criterion. One thing particularly noticeable is the number of shop-keepers who use them instead of gas, almost making one think that the time-honoured joke on the "fibbing" propensities of gas meters is at last being taken seriously, and that people have realised the fact that they can never be certain they have had their money's worth of gas.

I notice, too, that oil is replacing the gas for street lighting in one or two places in London. Verily, history repeats itself. I quite expect in the near future that we shall have the lamplighter impartially distributing the oil over the passers-by in the good old style.

There is a class of people who would be glad to use oil instead of gas, but the fear of fire or explosion deters them. They read the report of the latest fatal lamp accident, and putting the paper down with a shudder, determine to stick to the gas. "For," they argue, "if I use oil, why should not such an accident happen to me?"

This is all very well, but it assumes that there is only one kind of lamp in existence, and that dangerous; an assumption that a moment's thought would show the absurdity of. There is a large number of different styles of "safety" lamps in the market, some of them good, some otherwise. I do not purpose picking out one style of lamp and holding it up for universal admiration and imitation, but rather to point out the defects which nine out of every ten lamps possess—even the best.

First as to the burner. The different styles may be roughly divided into those having flat wicks, and those with wicks which take a circular form. It is the flat wick burners that are so erratic, and cause the majority of the accidents.

On taking one of them in hand, you will notice that there is a sort of dome over the top, with a slit (or slits) in it, through which the flame rises. If you look through that slit you see the wick tube projecting through a piece of perforated zinc. Now if you suppose the lamp to be lighted, it will be easy to comprehend the reason why explosions take place.

The flame, of course, makes the dome very hot; the heat extends to the rest of the burner; and as a result the air drawn in through the perforated zinc to feed the flame, instead of being cold, as it is theoretically supposed to be in order to keep the wick tube cool, is really hot. This hot air, together with the heated dome and the flame, all combine to form a sort of hot chamber surrounding the wick tube. It is not, therefore, surprising that the oily wick in the tube gives off inflammable vapours.

Now, suppose the wick is rather thin and works very easily up and down, an exceedingly common occurrence, for people do not like a hard-winding lamp; or suppose the oil shopman is out of wick the exact width required—another very common occurrence—the chances are that he puts in a size smaller, and says nothing about it. The lamp is lighted as usual, and all goes well for the present. But now suppose the lamp is carried about—say upstairs, and, maybe, past an open door or window—a puff of wind reverses the air current momentarily, the flame is blown downwards, and the wick not fitting, allows it to ignite the vapour, which is, of course, present in force all round the wick. This, after flickering a few times, ignites the oil, and it ends in the coroner's jury recommending people to use safety lamps.

This matter of the good fitting of wicks is more important than is generally supposed. I nearly had an explosion myself through having the wick too narrow; in one of the oil cooking-stove lamps. The amount of error was only a little over $\frac{1}{16}$ in., and yet, when I happened to look a few minutes after lighting it, I found the flame flickering down the edge of the wick into the reservoir. I subsequently got over the difficulty by care in trimming: rubbing the charred portion of the wick from the centre, and thus spreading it out—a rather precarious method at the best.

The blowing downward of the flame is almost peculiar to flat wick burners. A large chimney has to be used, and as a consequence the draught is very weak, and the flame unsteady. The duplex burners are, of course, better, as the increased heat causes a stronger draught, but, as a consequence of this, they take some time to put out.

We now come to another danger, common, I believe, to all classes of burners—*i.e.*, the liability to turn the lighted wick down into the oil. The danger is greater with the flat wicks, because the length of the wick tube is less. That this danger is recognised, is proved by the number of contrivances which have been introduced for extinguishing the lamp instantaneously, and without turning down the wick, a contrivance which you will notice has not been applied to round wick burners.

If the extinguisher is adapted, and the wicks fit well, there is nothing to be said against the flat wick burner, except that it does not give a steady flame, and the chimney is apt to get smoky if the lamp is carelessly trimmed.

Now let us turn to the round wick style of burner (the Argand), of which Fig. 2 gives a full size view. Burners of this kind are very much used now, and I think deservedly. Observe the length of the wick tube—nearly double that of a flat wick burner. There is evidently not much danger of turning down the wick into the oil. Notice, too, that the air is drawn in at the bottom of the burner, a considerable distance from the flame, giving one the impression that the burner is kept cool during use. This is, in fact, the case, for after it has been alight for some hours, the burner is cool to the hand, and the draught is so good that the chimney may be taken off by the unprotected fingers, if it is taken hold of close down by the burner. The flame can be turned up to three or four inches if the lamp is well trimmed, and excepting a slight movement at the top, is free from anything approaching flickering. The draught being very strong, the flame cannot be blown downwards. In fact, the Argand burner is altogether as safe as it is possible to make a burner, and does not need any of those strange and wonderful "safety" contrivances.

So much for the burners. We now come to another important point, and that is the reservoir.

A very large percentage of the annual deaths from lamp accidents is due to the china or glass reservoir. The lamp is dropped or knocked over, or perhaps explodes. In either case the blazing oil flies all over the place. I am aware that there are many arrangements whereby it is rendered practically impossible for the oil to ignite if the lamp capsizes, but granted they do all that is expected of them, and that in addition the burner is quite safe, still, glass reservoirs ought to be avoided, for all the safety burners in the world will not save your lamp from smashing, and your carpet from spoiling, if the lamp is knocked over.

I do not wish to convey the impression that all cheap lamps are necessarily dangerous, and that it is necessary to have an expensive one in order to be free from risk, but I would urge on everyone who uses, or contemplates using, lamps, to see that they

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have metal reservoirs, for it is very unlikely that the force of an explosion would burst metal, and if it neither bursts nor breaks, there is evidently not much danger.

There is just one more point I want to call attention to before starting on the practical part of this article. It chiefly concerns people whose fear of injury prevents them adopting lamps in preference to gas.

On looking over the accounts of lamp accidents, one finds it an almost invariable rule that the sufferers are people low down in the social scale—poor people, to put it plainly. Whoever heard of one of the "Upper Ten" suffering from a lamp accident? I never did; and if any reader can call to mind an instance, it would only be an exception, and exceptions, as you know, prove the rule. The fact of the matter is, that the poor are the only purchasers of those cheap, showy lamps, usually sold for 1s. 0½d., complete—glass reservoir, vile burner, bronzed-iron stand, and fairly top-heavy. What more can they expect for their money? Not much, certainly. True, they can get a better, and infinitely safer, lamp, in the shape of the 6½d. tin hanging lamp, but it is so inconvenient and ugly, that it is not surprising that its more showy and dangerous rival is preferred for ordinary domestic use.

The lamps I am about to describe are safe enough if care is used in choosing a burner. When I made my first reading lamp (Fig. 1), with a burner of the kind illustrated, I put benzoline spirit into it in mistake for paraffin. After some hours the vapour of the spirit ignited in the chimney, but the flame was prevented from extending to the reservoir by the strong draught. If a lamp will not explode with benzoline, it is quite certain it will not with paraffin.

The first lamp I purpose describing is the reading lamp, Fig. 1. The cost of materials totals up to what may perhaps seem a good deal, but a safe lamp, giving a good light, and having a good appearance (qualities which do not always go together), cannot be obtained at as little cost as a "family exploder." Good articles (and materials) are rarely cheap, and the converse is equally true.

Now just a few words as to what I consider to be essentials of a good reading lamp. The first and most important is, that the reservoir should not be so large that the table is in deep shadow for some distance round the lamp. This is generally the case with lamps which do not slide up and down, such as those with the metal base and cut-glass reservoir. They certainly look very imposing with the ornamental paper shades about two feet in diameter, but they are of no use except to show off the shade. Another point is, that the burner and shade should be adjustable at any height independently of each other. In the majority of reading lamps, the shade is fixed to the reservoir or burner, with the result, that if it is required to show a light round the room, the hot shade has to be taken off altogether.

It goes almost without saying that the lamp should be firm on its base. This is assured in the lamp illustrated, as the peculiar form of the base gives great stability without much weight, the stability depending not so much on the weight as on the shape. Indeed, I see no objection to making it of hard wood instead of cast iron, provided some means can be devised for securing the upright rod firmly, and without liability to twist. So much for the theory. Now for the practical part.

The burner can be obtained of Messrs. Benetfink, 107 and 108, Cheapside, London, E.C., and probably of other lamp makers and dealers. Ask for it by the name of the "Kosmos" burner, large size (the word "Kosmos"—trade mark probably—is embossed on the milled head of the wick-winder), and be sure and get the collar for it to screw into; price, complete, about 3s. net. There is another burner of the same make, but only about half the size; that is not the one intended. Of course, there are other burners, perhaps equally good, and, maybe, one or two that are better. Intending makers of the lamp can please themselves. I only mention this particular burner because I am most familiar with it, and have tested it fully. If you use the style of burner I recommend, I can only say, beware of cheap imitations. The burner intended is most beautifully finished, and the outside is burnished; the imitations are merely stamped into form. If another kind is used, see that the chimney is small enough to go through the hole in the shade without touching. The shade can be obtained in either of the shapes I have shown (Figs. 1 and 3), green glass outside and white in; price about 1s. 6d. net. The general size of these shades, and the size required, is 7¼ in. across the rim. The shape shown in Fig. 1 can be got in opal for about 6d., but the green shade looks more refined. As to the best shape, I think that in Fig. 1 throws down the light better. I generally use a paper shade when using the lamp to do rough work by, in case accidents might cause a run on the eighteenpences. The chimneys cost about 4d., and being made of German glass, with care in cleaning last for years. Lengths of special wick are sold in boxes of one dozen, but the ordinary flat wick obtainable at the oil-shops, and sold by the yard (about 1s.), answers all purposes. A quarter of a yard is a convenient length for the wick of this lamp.

It is astonishing how few people know how to trim a lamp properly. Smoke and smell seem to be accepted as one of the evils of this life for which no remedy exists. The few hints which I give on the subject of trimming, although especially intended for the particular lamp I am describing, are applicable, to a certain extent, to lamps in general.

Dry the new wick thoroughly before putting it in, and cut it as level as possible before any oil gets on it. Scissors are of no use in cutting a round wick after the first time. After it has been alight once, the very best way to get it level is to put a corner of the duster over the finger and rub the charred part off. Some of the pieces may fall into the burner; to get them out, unscrew the part that holds the chimney from the rest of the burner (Fig. 2 divides just above the winder). Never fill the reservoir right up to the top, as it increases the amount of oil which oozes over in all lamps, particularly if they are moved about much. If the common oil is used the impurities settle at the bottom, and after a time give a muddy appearance to the oil, causing the lamp to burn badly; it is therefore necessary, once in awhile, to clean out the cistern.

It may happen that after the lamp has been in use some time, one end of the wick gets higher than the other, like Fig. 4. This is easily remedied by pulling up the lowest end with the fingers. When putting in a new wick, however, it is of no use trying to get the ends even without cutting them.

Some sheet brass and wire will be wanted from the metal warehouse. About 2 ft. of 9 in. No. 9 roll brass will be enough. This brass is kept in rolls of various widths and thicknesses, and is very useful for a variety of purposes. Get also 30 in. of flat brass wire, ½ in. by 1/16 in. This flat wire is also useful for a number of purposes, such as key labels, nuts, etc. Eighteen inches of 5/16 in. square brass wire will also be wanted. Two or three patterns will be wanted, but they are very simple, being made exactly like the casting required. The parts of an old stand might, perhaps, be utilised to save making one or two patterns, but I do not advocate the employment of old lumber in work of this kind, which is always in sight. Another reason is, that no amount of good and

Fig. 3.

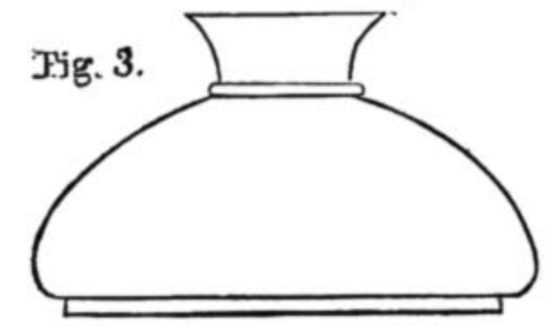

Fig. 4.

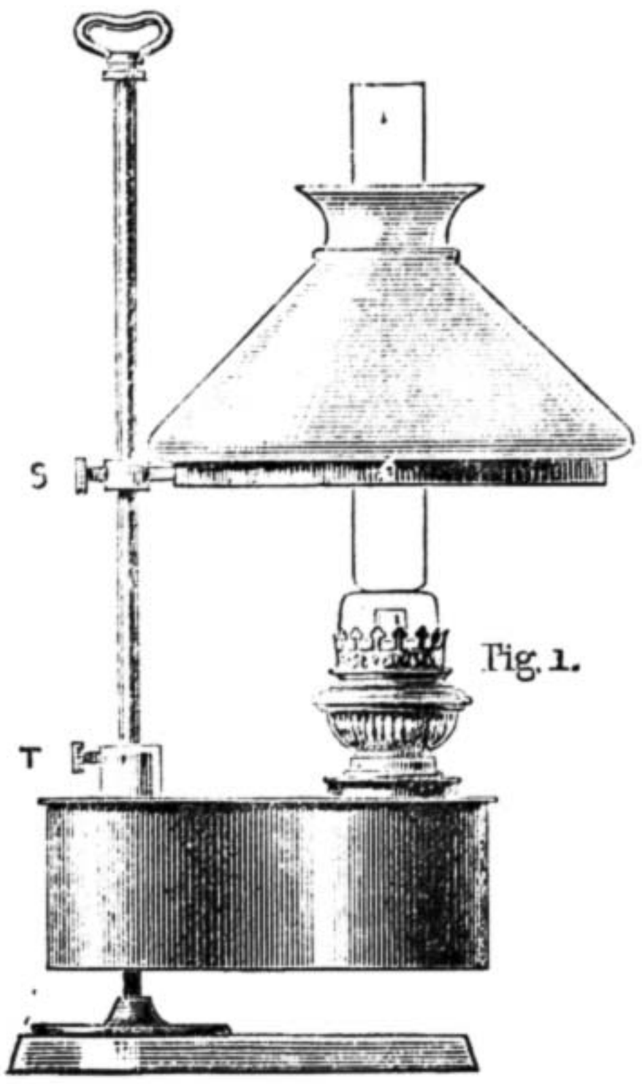

Fig. 1.

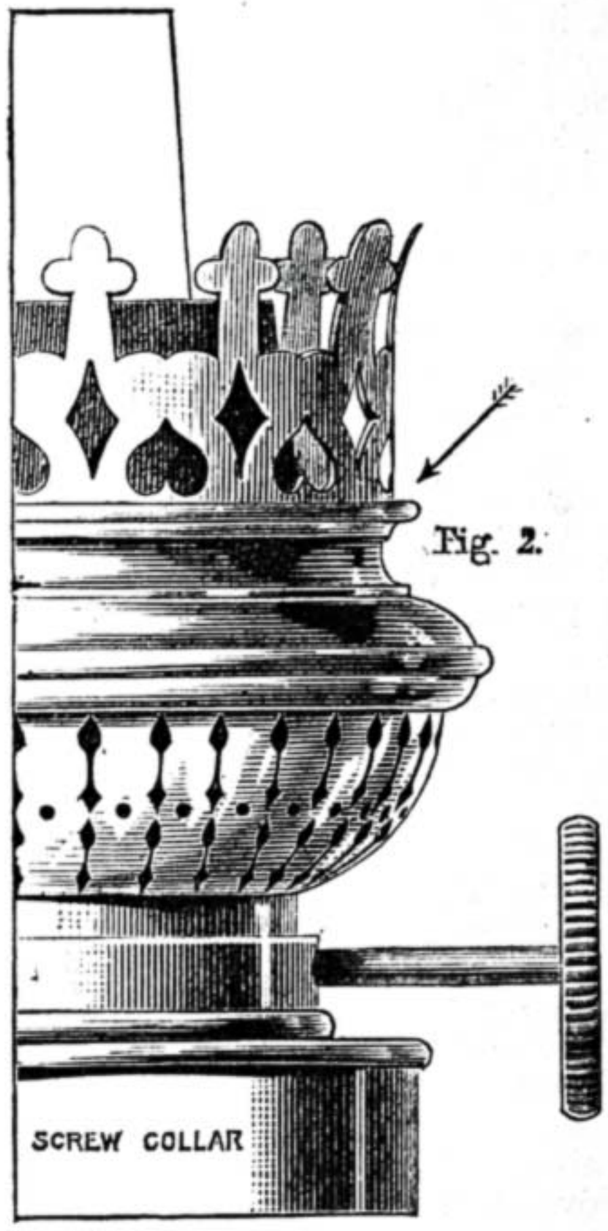

Fig. 2.

Paraffin Lamps. Fig. 1.—Reading Lamp complete. Fig. 2.—Burner (full size). Fig. 3.—Alternative Shape of Shade. Fig. 4.—Faulty Position of Wick.

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careful workmanship put into an article composed of odds and ends of lumber, will make it look other than one of the noble army of makeshifts.

AN ARMCHAIR: HOW TO MAKE THE FRAME AND UPHOLSTER IT.

BY DAVID ADAMSON.

SEAT FRAME—TENONS IN SIDE RAILS—EAST END FURNITURE.

OF equal importance with the back is the construction of the seat frame; and here possibly a few little matters may perplex the novice who is attempting to make a chair for the first time. The back and front rails are simple enough, as they are merely squared ends, but the sides, being shaped, will require some consideration. Before going further, let it be said that the rails are either tenoned or dowelled into the legs. Some authorities contend that the former is the only legitimate construction for chairs, while some equally competent practical men invariably use dowels. I do not intend here to discuss the question which is the better method of the two—if, indeed, when equally well done, there is any superiority in one of them over the other. I refer merely to durability and stability, for it may almost be considered as beyond dispute that a dowelled joint is more quickly made by inexperienced workers, if not more easily, than by those whom practice has made equally adept in forming either.

Now it will be evident to the most casual observer that the tenons on the side rails may be either in a straight line with them, so that the mortice is cut in a sloping direction from the face of the leg, or that they may be so formed as to enter a mortice cut square into the leg. Both methods are shown in Figs. 7 and 8, which it will be understood are given merely as diagrams to explain the different constructions, and are not intended as working drawings from which measurements are to be taken. In Fig. 7 we have the tenon cut with its sides parallel with those of the rail, the mortice in the leg, on account of the slope of the side, being made at a corresponding angle. In Fig. 8 we have the alternative when the mortice is cut at right angles into the leg in the usual manner, the tenon for it projecting to the same degree from the bevelled end of the rail.

Fig. 7.—Tenon in Side Rails: Mortice in Legs correctly cut.

Which, then, of the two methods shall the chair-maker adopt? To set his mind at rest, let it be said that the construction shown by Fig. 7 is the better of the two, and that few, if any, practical chair-makers would prefer the latter, even were they not to say it should never be practised, which most good men would. The objection to the formation shown on Fig. 8 is based on common-sense reasons, and though I am far from saying that there are no occasions on which it might be used with advantage, they are quite exceptional ones, and the beginner should certainly prefer the other. But to give him some reason for this. The rails, it is safe to assume, will be of some straight-grained wood, with the grain running in the direction of their length; and having said this, the reason for preferring the tenon cut, as in Fig. 7, will be evident almost without explanation. The tenon is naturally the weakest part of the rail, but if it is straight-grained, there can be no doubt it is stronger than if cross-grained. The weakest form of tenon, of course, would be one with the grain running straight across, but even diagonally the wood cannot be so strong as when cut properly. In Fig. 8 it will be seen that the tenon is to a degree a cross-grained piece, while in Fig. 7 it is not so. It will be hardly necessary to say more on this point; but perhaps I might explain that though the word "tenon" has been used, the remarks apply—though not to the same extent—to dowels. These it will generally be found better to be as in Fig. 7 than as in Fig. 8. The dowel, however, being a straight-grained piece, may have greater liberties taken with it than would be safe with a tenon. Either with dowels or tenons, be very careful that they fit tightly, and rely more on this than on glue to fill up loose joints, which, after all, is nothing more than is necessary in any good joinery. A difficulty may arise about getting the dowel holes opposite each other and in their proper positions, both in the legs and in the rails. Careful measurements will, of course, prevent mistakes, but it will be much simpler after the ends have been properly squared—or, rather, mitred off, in the case of the side rails—to cut a piece of veneer, thin wood, or card to fit the face of the end. By puncturing holes in this card, an accurate template is formed for the dowel centres, both in the legs and in the rails. It will be as well to see that the dowels in the side rails do not interfere with those of the front and back rails. Let them clear each other in the legs, instead of cutting through or into one another. By marking out the dowel templates properly there will be no risk of this; and I think the matter is so clear that nothing more need be said about it. If, however, any considerable number of readers should experience a difficulty about it, I shall be pleased to be more explicit when treating of the construction of some other chair on a future occasion. I may say the same generally about any other point which may not be quite clear to novices, for it is obviously impossible to foresee all the little difficulties which may occur to them, though I fancy if they will consider a little most of them will disappear. Every fresh piece of work a man undertakes will present some new feature of difficulty, and no instructions can do away with the necessity for thought on the part of the worker. I am often met, when amateurs ask me how to do certain definite things, with some supposititious questions after this sort: "Well, but how would you do in such and such a case?" the contingency of the form of construction or the material being so remote as not to be worth a moment's consideration till it actually occurs. On the fertility of resource to surmount the difficulties which are constantly occurring even to the most experienced, the value of the worker depends. The more experience a man has to draw on, the better, of course; but though practice will enable most to become proficients in merely manual dexterity in a limited class of work, it does not obviate the necessity for thought when anything outside the usual run is attempted. The best and most valuable workman is he who uses his brains as well as his hands. This may seem altogether beside the matter of our chair; but what I want to urge, if I may, is that our craftsmen should not be content to degenerate into mere skilled labourers in one branch of work, but that they should, when necessity arises, be able to turn their hands to the construction of anything in which the same materials and class of tools are used. In the East End of London, for example, it is no uncommon thing—not going beyond chair-frames—to find men who are incapable of making anything out of their usual rut. They are good, say, at dining-room small chairs, but are quite incapable of making easies, couches, or the numerous class of fancy frames. This should not be; for without saying that a man should not—indeed, almost must, if he wishes to succeed in any of our large centres—become a specialist in the construction of any given class of articles, it seems ridiculous that he should be content to limit his constructive capacity. That there are men who are good all round is not to be denied, but on the contrary, how often do we find a man who is quite content to set a self-made boundary to what he can do? By all means let a man be a specialist, but because he is particularly skilled in making one thing, or in one branch of his craft, that is no reason why he should not have acquired some proficiency in others. Complaints are numerous that Germans and foreigners generally are making things harder all round for the English artisan, but surely in cabinet-making—or, rather, let me say, in joinery work in all its branches—this is rather a slur on native talent. It is rather owing to the self-imposed restrictions of the English worker, and his too ready acquiescence in the fallacious notion that because he is clever at one thing, therefore he need not know anything more. In saying this, I am not forgetting the vast amount of slop stuff made by the foreigners in furniture workshops; but is all English work of the best? and might not much of it, especially of the common-made London kind, be considered equally poor? I don't think it is sufficiently well known that this rubbish is sent to all parts of the country; and without saying that nothing of an inferior quality is made in the provinces, or that all London furniture is bad, it is an undoubted fact that more of the lowest class of furniture is put together in London than in all the rest of Great Britain. The share the general public have in encouraging the production of such need not be enlarged on, but it is a somewhat singular thing that most of the lowest-priced and worst furniture is made by men who limit their work to the production

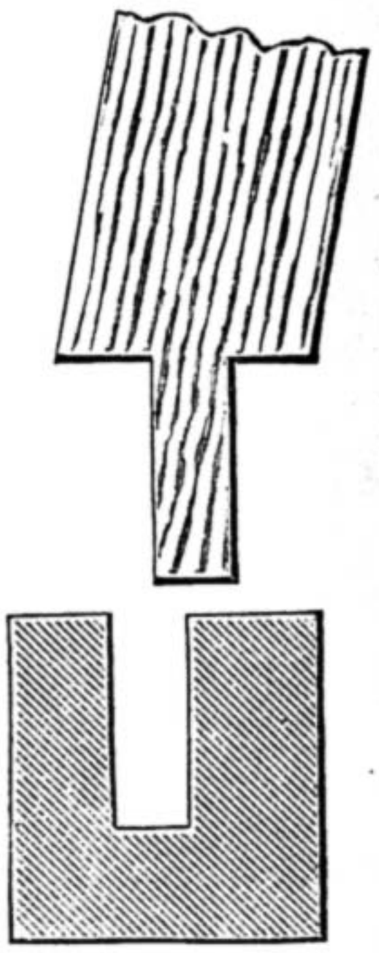

Fig. 8.—Tenon in Side Rails: Mortice in Legs incorrectly cut.

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of a very limited range of articles. I would, therefore, earnestly urge the young artisan not to be content with learning only one branch of his trade, but to become as conversant as his abilities and opportunities will permit with others. He won't be a whit the less able in the one to which he devotes his special attention from knowing others, and there is no reason whatever why, whenever occasion may arise, the cabinet-maker should not be able to make in its entirety the chair-frame under consideration. I hope amateurs will pardon this digression, which may possibly seem a needless one to them, although they may find the remarks suggestive.

Reverting to practical consideration of the chair, it will be seen from Fig. 4 (p. 411) that the outer edges of the rails are set a trifle within the legs. It is not absolutely necessary that they should be so, but it will be better that they should, in order that the thickness of the coverings of the upholstery may not project beyond the squares or uprights. There is, I believe, no recognised rule for this, but about $\frac{1}{8}$ in. is sufficient. If the frame is made for a very thick cover, a little more might be allowed, but as a general thing it will do very well. It merely remains to be said, that the rails will be quite stout enough if made from 1½ in. stuff, though of course they may be more, and in any case they should hardly be less than about 2 in. deep. Perhaps some may want to know how many dowels should be used for each rail. If so, it may be said that a couple at the end of each would do, but as there is plenty of room for them, three will be better, for the side rails especially. Braces, as the small corner blocks often used in chairs are called, are not necessary in the present one, but if the seat should seem rickety, or if there is any fear of it becoming so, they may be added. As, however, they should not be required, no special remarks about making and fitting them need be given.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

HEATING EFFECTS OF ELECTRIC CURRENT IN LAMPS—CANDLE-POWER OF LAMPS—RADIANT POWER OF INCANDESCENT LAMPS—ELECTRIC LIGHTING BY MEANS OF PRIMARY BATTERIES.

Heating Effects of Electric Current in Lamps.—When an electric current passes through a wire, the current encounters resistance to its passage, and part of its energy is expended in overcoming the resistance of the wire. This expenditure of energy causes a rise of temperature in the wire, and its resistance increases as its temperature is increased by the current. But, when the current passes through a carbon filament, its effect thereon is entirely opposite to that on a metal wire—that is to say, the resistance of a carbon filament is greater when cold than when it is hot. Mr. Sprague estimates that a filament of carbon in an incandescent electric lamp offers twice the resistance when cold that it does when at full light-giving temperature. It is most important to note and remember this whilst dealing with incandescent electric lamps. In planning an installation, we have to take into account the resistances likely to be encountered in the circuit, and must make allowance for the difference which exists between the cold and the hot resistances of the lamps. The heat given out by an incandescent electric light may be put down as one-tenth of that of a gas light of equal candle-power.

Candle-power of Lamps.—Much misapprehension still exists in the mind of the public respecting the light-giving power of incandescent electric lamps, and a just comparison of the light from one of these with that of a gas-burner or a paraffin lamp. In all exhibitions of the electric light, some grand effects have been produced in lighting, by grouping several incandescent lamps together. This has enhanced the value of the lamps in the eyes of the visitor, who has, consequently, gone away with a wrong impression respecting the real light-value of a ten candle-power incandescent electric lamp. The term "candle-power" is derived from the candles used in the English standard system of photometry or light measurement. The candle used in this system is a spermaceti candle, weighing six to the pound, and burning at the rate of 120 grains per hour. Lights are tested by this system with an instrument named a Bunsen photometer. This is a metal bar, at the two ends of which are the lights to be compared. The bar is graduated with a scale representing standard candles, and on the scale is made to slide a screen of white paper with a spot of grease on the middle. This screen is moved along on the bar until the spot of grease is equally visible or indistinguishable on either side, when it is known that the two lights have equal power upon it, and the respective strength of their lights is then known by reference to the scale. Some idea of the comparative value of incandescent lamps with gas lights, may be gathered by knowing that a Sugg's Argand gas-burner, giving a flame exactly three inches in height, always represents a light of sixteen candle-power, whatever quality of gas it may burn.

The light-giving power of an incandescent electric lamp is governed to a certain extent by the area of carbon surface brought by the electric current to an incandescent condition. But there are various shades of incandescence, so to speak, obtainable from a carbon filament, and, consequently, the candle-power of a lamp depends upon the degree of intense whiteness to which the filament has been brought. The highest illuminating power is obtained from these lamps when the filament not only glows white, but also gives forth a sparkling white light; but it should be observed that few filaments can stand the intense vibration necessary to produce this light. In all cases, to run lamps at such high temperatures, means a shortening of the filament's existence, and only the very best survive for long such treatment. It has been shown before that the light from one of these lamps depends largely upon the volume of current which may be pushed through the filament of carbon, and I have shown that the resistance of the carbon decreases as it becomes hot. Therefore, to bring the filament to a sparkling white condition, we must push through it a larger volume of current than it carried when only white hot. This is achieved by increasing the electro-motive force of the current together with its volume; and, consequently, the filament is subject to a higher strain. In the following table, from the Edison and Swan Company's price list of incandescent lamps, the limit of the electro-motive force is noted, beyond which it is deemed not safe to go. The variation of the candle-power of each lamp and the current required is also noted. In this table (and for all future purposes in this article) the abbreviations "E.M.F." and "c.p." stand for electro-motive force and candle-power respectively.

TABLE OF EDISON-SWAN LAMPS.

C.P. of Lamp.	Voltage.	Ampères of Current.	Limit of E.M.F.
1	3 to 8 volts	·8 to ·3 ampères	8 volts
2¼	5 „ 8 „	1·4 „ ·45 „	8 „
2¼	9 „ 25 „		25 „
5	10 „ 35 „	3· „ ·35 „	65 „
8	15 „ 25 „	2·8 „ ·3 „	120 „
8	26 „ 55 „		120 „
16	30 „ 105 „	3·7 „ ·4 „	120 „
25	45 „ 105 „	2·2 „ ·7 „	120 „
32	55 „ 105 „	2·3 „ ·9 „	120 „
50	80 „ 105 „	3·5 „ 1·4 „	120 „
100	80 „ 105 „	7· „ 2·9 „	120 „

It will be seen from this table that the c.p. of light can be obtained by pushing a large current through a short and thick filament, or by pushing a smaller current through a long and thin filament offering a higher resistance. For instance, a lamp taking a current of 3 ampères sent through a short and thick filament at a pressure of 10 volts, will give a 5 c.p. light, and the same value of light is obtainable from a lamp with a long and thin filament taking only ·35 ampères of current, but requiring an E.M.F. of ·35 volts to push this current through the extra resistance. The result in watts of current required to bring the carbon filament to a proper incandescent condition, will be found to be higher in the low resistance lamps than in those of high resistance. It may be explained here that the unit of measurement denominated a watt, is obtained by multiplying the total volume of current in ampères by its pressure in volts. Let us take, as an example, the current required for a 5 c.p. lamp as stated above. In the case of a lamp requiring 3 ampères of current with an E.M.F. of 10 volts, we have

$$\frac{\text{amps.} \times \text{volts.}}{5 \text{ c.p.}} = \frac{3 \times 10}{5 \text{ c.p.}} = 6 \text{ watts per c.p.}$$

If we choose a lamp with a higher resistance requiring a voltage of 35, we have

$$\frac{\text{amps.} \times \text{volts.}}{5 \text{ c.p.}} = \frac{\cdot 35 \times 35}{5 \text{ c.p.}} = 2 \cdot 45 \text{ watts per c.p.}$$

Dividing these by 2 we get an average of 4·22 watts per c.p. This is rather above the general average of those lamps, which is about 3½ watts per c.p. for lamps taking less than ·9 ampères of current.

Radiant Power of Incandescent Lamps.—The radiant power of incandescent electric lights, or their ability to illuminate space around them, is shown by the following table, which will be found useful to readers wishing to know how many lamps of a certain c.p. should be employed to light up a room. This table is slightly altered from one given elsewhere, in which the figures expressed decimal parts of a system. I have avoided the decimals and have given the round figures nearest these, expressed in feet and inches for the sake of simplicity. Nevertheless, although for the convenience of the reader, and to enable him the better to fix in his memory, I have constructed the table in this manner, it will be found sufficiently close for all practical purposes. It is desirable, I am well aware, to be exact whenever one can, but in this case I am inclined to think that the exactness—which, as I have said, would involve decimal parts—would be more perplexing than helpful.

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TABLE SHOWING LIGHTING POWER OF INCANDESCENT LAMPS.

Dimensions of Room.			Number of Lamps.			Height of Lamps above Floor.
Length.	Width.	Height.	10 c.p.	16 c.p.	20 c.p.	
Feet.	*Feet.*	*Feet.*				*Ft. In.*
15	15	12	3	2	1	8 0
18	18	16	5	4	3	8 6
24	24	17	9	7	6	9 6
33	33	23	16	12	10	10 0
37	37	32	25	19	16	12 6
52	52	40	40	30	26	14 0
63	63	46	60	45	40	17 0
72	72	52	100	75	68	21 0

Electric Lighting by Means of Primary Batteries.—Suppose, now, we wish to light up a room with the electric light in a manner equal to the light obtainable from two of Sugg's Argand gas-burners representing 16 c.p. each burner. We may get this light by using one large lamp of 32 c.p., or two smaller ones of 16 c.p. each, or four lamps of 8 c.p. each, or, perhaps, eight lamps giving a light of 5 c.p. each lamp. If we employ one large lamp of high resistance—say, a 60 volt 32 c.p. Edison-Swan lamp—we must also employ a high E.M.F. to overcome that resistance; but since, as a rule, the amount of current required to produce a given light diminishes with the increase of resistance (though not in the same ratio), it follows that to obtain a given candle-power, it is optional with us to use, either lamps of low resistance taking many ampères of current at a low pressure (*i.e.*, low E.M.F.), or a lamp taking a fraction of an ampère at a high pressure. What really decides the matter is the convenience which we have for obtaining either the E.M.F. or the large current.

Now, to obtain a high E.M.F. from batteries, means the employment of *many* cells, since we have no cell which gives an E.M.F. of more than 2 volts. On the other hand, if we wish to use a large current, we must employ large cells, since small cells offer a high internal resistance, and this pulls the volume of current down. In the case of a dynamo, the E.M.F. can be increased in two ways: either by putting more wire on the armature, or by driving faster, so as to cut more lines of force in a given time. In putting on more and finer wire on the armature, we do not use the finer wire because in itself it gives a higher E.M.F., but because we can get more coils of a finer wire in the same space, and thus cause more yards of active wire to cut the lines of force in a certain time.

In the former case, the E.M.F. of the dynamo increases with the length of the wire, so also does the resistance. In the latter case, when the speed is increased, the wire of the armature becomes heated through being obliged to carry the larger current.

If we employ more than one lamp of high resistance, and place these in circuit with the machine so as to form branches of the circuit, or conduits for the current between the main wires of the circuit, we shall lower the total resistance, and a current of lower E.M.F. will suffice. But in this case we shall require a larger volume of current, and thus a similar expenditure of energy to furnish the increased current at a lower E.M.F. Suppose, for instance, we use 1 lamp requiring 1 ampère of current at 60 volts pressure. We know by the rule already given, that 60 watts of current energy will have to be expended in lighting the one lamp, since 1 ampère multiplied by 60 volts equals 60 watts. Now we couple two such lamps in parallel—that is, place them side by side to form two bridges across the space between the two line wires. We have now two channels open through which the current can pass, and the resistance falls to one half of what it was when only one lamp was used, since $\frac{60}{2}=30$, so we shall only require an E.M.F. of 30 volts to push the current through the lamps. But, as we have now two lamps, each requiring one ampère of current, we shall require a current of two ampères, and 2 ampères multiplied by 30 volts equals 60 watts as before. If we carry the sub-division to six lamps, we shall find it governed by the same rule: $\frac{60 \text{ volts}}{6 \text{ lamps}}=10$ volts, and 10 volts multiplied by 6 ampères equals 60 watts.

Suppose, now, we decide to light up our lamp by means of current obtained from a primary battery. Let us first select our battery, and then, before purchasing it, sit down and count the cost. As the Bunsen battery is a powerful one, having a high E.M.F. with a low resistance per cell, we first see what can be done with that battery. The E.M.F. required to light the lamp is 60 volts: the E.M.F. of a Bunsen cell is about 1·86 volts. If we divide 60 by 1·86 we get 32 cells in series as the number we shall require to make up the battery. Let us see what current we shall get from this battery. Estimating the resistance of a quart Bunsen cell at 0·08 ohm, the hot resistance of the lamp at 30 ohms, and the resistance of the line wires at ·5 ohm, we get by Ohm's formula—

$$\frac{1\cdot86\times32=59\cdot52}{0\cdot08\times32+\cdot5+30=33\cdot06}=1\cdot7 \text{ ampères,}$$

and this is about the quantity of current needed to light up an Edison-Swan 60 volt 32 c.p. lamp.

Using the current from this battery at the rate of 1·7 ampères per hour, it will only work some six or seven hours at the most at a time without recharging. Let us see, therefore, what it will cost to get a 32 c.p. light for this time by the means under consideration.

The cost of the installation will probably be as follows:—

	£	s.	d.
32 qt. Bunsen cells, complete, at 4s. 6d. per cell	7	4	0
6 lbs. sulphuric acid at 2½d. per lb.	0	1	3
12 lbs. nitric acid at 6d. per lb....	0	6	0
1 32 c.p. incandescent lamp	0	5	0
1 lamp-holder	0	1	0
Connecting and line wires, about	0	1	0
	£7	18	3

To provide 1·7 ampères of current, the battery will consume in each cell 31·46 grains of zinc per hour at the least; but probably this will be exceeded owing to local action in the cells, consequently nearly 1 lb. of zinc will be consumed in addition to acid used during the run of six hours. The working cost will, therefore, be not less than ½d. per c.p. per hour for material alone. To this must be added the value of labour in setting up the cells and cleaning them after the run is ended (which will be a serious item), together with a fair allowance for depreciation of plant. It should also be understood that a Bunsen battery working under these conditions cannot be tolerated in the room to be lighted, but must be kept out of doors in a shed, or in some place where a strong draught can be arranged to carry the noxious nitrous fumes away up the shaft of a chimney.

Instead of employing this number of Bunsen cells proper, we may modify the charge of the inner cell, using a solution of chromic acid instead of nitric acid, and thus get what may be called a chromic acid battery, each cell of which will give an E.M.F. of 2 volts, whilst only offering an internal resistance of 0·06 of an ohm. By this arrangement we shall be able to reduce the number of cells down to 27, with a consequent saving in first cost of £1 2s. 6d., and, as the chromic acid solution will only cost 1s. per quart, a saving of 1s. 6d. on each charge. But, although we have secured enough E.M.F. and current to work the lamp with a smaller number of cells, and have also avoided the noisome stench of the nitrous fumes, our new arrangement will not be nearly so constant in action as the old one. The chromic acid cell soon polarises whilst yielding a current of 1·7 ampères (unless its solution is kept constantly in motion by mechanical means), and, consequently, ceases action at the end of three hours.

If we employ lamps of lower c.p. and of lower resistance—for instance, two 16 c.p. lamps having a cold resistance of 15 ohms each—on referring to the table of Edison-Swan lamps, we shall see that such low resistance lamps take a large quantity of current to light them, viz., 3·7 ampères each. This rapid outrush of current means more than an equivalent consumption of zinc, because the rapid consumption of this metal in the cells causes an evolution of internal heat, and this soon destroys the amalgamation and wastes the zinc through local action.

Again, if we employ several small lamps coupled up in parallel to form bridges between the main conducting wires from the battery—say, for instance, four 8 c.p. lamps instead of two 16 c.p.—the evil of heating the battery, through demand for a large volume of current, is increased and intensified, and to counteract these we must employ larger cells, or arrange our cells in parallel as well as the lamps. Even when thus arranged, the run down is very rapid, and the consumption of zinc and acid correspondingly large. From this it will be seen that batteries are the most inconvenient and bulky of all generators for providing current to electric lamps, and are only admissible where no other means can be employed, or in special cases where only small lamps are required.

Having thus shown the expense and inconvenience attending any attempt to light up a large room by means of primary batteries, I will next show what can be done in electric lighting by means of batteries, and what to expect from the current supplied by them.

A CORNER CUPBOARD WITH CARVED PANELS, OR FOR GESSO ORNAMENTATION.

BY E. BONNEY STEYNE.

NONE of the articles of furniture that modern taste has rescued from banishment are better worthy than the old corner cupboard. The word corner is always full of pleasant associations; the snug corner of a will, a corner of one's heart, a corner of the hearth, and so on, readily come to mind in proof of this.

There are very few rooms that could not spare a space for a cupboard such as this, and for a carver to display his skill, few surfaces repay him so well; for the result is hung like a picture, and well in evidence, in a way that hardly happens to carving bestowed on furniture. For here are no shelves to hide its beauties, no clock face

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to draw superior attention, but the whole, in spite of its use, might exist solely to display its ornamented panel, so far as those who see it are concerned.

The design chosen is that of the tree of knowledge—the Igdrasil tree—a well-known decorative symbol, yet always with a charm of its own, despite its frequent use. The M. and N. are, of course, merely the baptismal synonyms for the actual initials of its maker. Should he possess a family coat-of-arms, it might, of course, replace the date on the shield. The olive branches that surround them may be poor heraldry, but are sufficiently good sentiment.

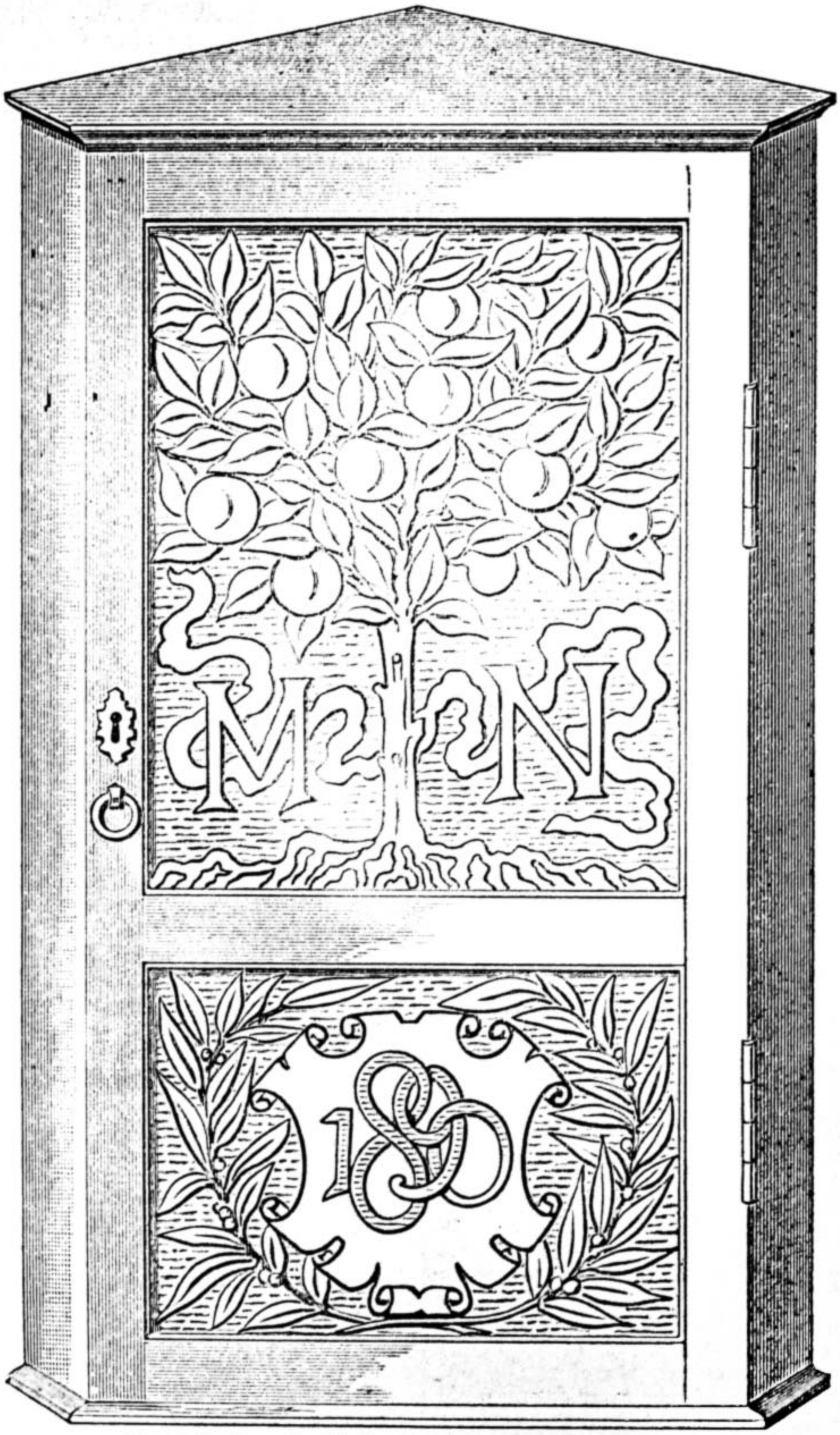
The old corner cupboard is so well known that I have abstained from working drawings, but should any one with skill to carve yet be ignorant, I fancy, wherever he may dwell, that he would not have far to look for an existing specimen, the study of which is better than any description.

The carving should be in low relief. If the owner's taste is in sympathy with its use, some shaded gold upon the fruit of the tree, and on the initials and date, would not be out of keeping.

If gesso replaces the carving, the final colouring may be either roughly naturalistic or purely conventional, with the background left in the natural wood or painted, as the owner chose.

The cupboard is rather broader in proportion than usual, but by lengthening the stem of the tree the design could be adapted to a narrower one without other alterations of any importance.

It will be noticed that the old corner cupboard, now so seldom seen in any but very old houses, has been reproduced in all its simplicity and severity of outline. The ornamentation and rehabilitation of the cupboard consist entirely in the treatment of the panels of the door. To those who wish for more embellishment I may suggest the overlaying of the door frame and sides with fretwork, with the addition of brackets below, and a gallery of spindles and rails at the top.



Corner Cupboard with Panels Carved or in Gesso Work.

A DARK-ROOM AND BACKGROUNDS IN COMBINATION.

NOVEL, PORTABLE, AND HANDY FOR AMATEUR PHOTOGRAPHERS.

BY A. S. P.

THE want of a suitable dark-room is generally a great drawback to the amateur photographer. A closet without windows, and necessitating the use of the ruby lamp, is usually the only place procurable; but such closets seldom make good dark-rooms, and in many cases the plates developed therein are failures. This new idea, that of a dark-room and backgrounds combined, must prove of great utility where space is a consideration; a dark-room that can be put together in two or three minutes, then, when operations are over, taken to pieces and stowed away, or the parts used as backgrounds. The construction is simple, and any amateur who can do a little joinery may easily make it. Fig. 1 is a view in perspective of the framework without the covering, and consists of a series of frames put together by mortice and tenon. The cheapest wood is white or Baltic pine battens, cut up into 2½ in. by 1 in., and of suitable lengths. The front and back frames are each 6 ft. broad and 6 ft. high, the two end frames are 4 ft. broad and 6 ft. high; the front frame has the opening for the door 2 feet wide; and the right-hand end frame, the opening for window, 19 in. by 13 in. The roof frame is made 6 ft. by 4 ft. 2 in., from which it will be seen the front and back frames overlap the end ones at the edges. This roof frame has a ledge of ½ in. wood 2 in. broad, nailed all round, and projecting downwards like the lid of a trunk. This shuts down over the edges of the top of the four frames, and keeps the structure rigid and perfectly light-tight. The frames are put together by mortice and tenon (see Fig. 3, A, B). The mortices being cut through, and the frames put together with glue, the tenons are wedged on the outside.

The front and back, also one end, have each a rail midway of the height, also morticed in the same way. The window end has two cross rails and two uprights to form window opening (see perspective, Fig. 1, and also Fig. 4). The rail A, Fig. 4, is 30 in. from the floor. To this rail is hinged the table inside, and the short post C has a hinged bracket made to fold aside and allow the table to fold downwards. The door frame, Fig. 2, is made to fit the opening in the front exactly, and may be hinged to the door post A, Fig. 1, or to the corner post B. The door opens outwards, and in order that the door, when shut, may be perfectly light-tight, a check is screwed on all round inside the opening, projecting into the opening half an inch or so. This check is put on after the cloth covering has been tacked to the frames. The hinges for the door should be sunk into the edge of the door frame to secure a close-fitting joint. The frames, having been put together with glue and wedged firmly, are to be cleaned off, squared, and fitted together temporarily with screw-nails as a skeleton framework, as represented in perspective, Fig. 1. The roof frame is now fitted on with the ledge before mentioned, giving allowance for the cloth covering, about a sixteenth of an inch all round being sufficient. The screws are now taken out, and the various frames and door covered first of all with stout brown paper. This covering is put on both inside and outside. The paper is cut to the sizes to fit the various parts of the frames, then damped

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to within an inch of the margin, and pasted in place. When dry, it will be stretched as tight as a drum. The paper must be pasted to the sides of the frames, not the edges. Now proceed to cover the outside only with strong calico, and as this material will be too narrow in the web for the frames, two breadths must be sewed together. The method of sewing the calico together is explained in Fig. 8. The two pieces being laid together, a seam with the sewing machine is run up some $\frac{3}{8}$ in. or $\frac{1}{2}$ in. from the edge. The two selvages thus turned in will go towards the frame, giving the opposite surfaces to paint on for backgrounds. The cloth is now stretched on the frames, and nailed with tacks in the edges only, not the faces of the frames. The several frames with cloth on the one side and paper on the other, give a choice of surfaces for painting on, and one or both sides may be utilised as backgrounds.

The end frame, with window opening, makes a very realistic background by painting the plain surface of the calico to represent an old ruined wall, with real or imitation ivy clinging to it and around the window. The effect of this background may be heightened by making the sitter look through the window opening. Indeed, the complete dark-room may be made to represent a small rustic cot or cabin by painting an imitation window on the front with the doorway. The amateur must, of course, be something of an artist to carry out these ideas. An important consideration

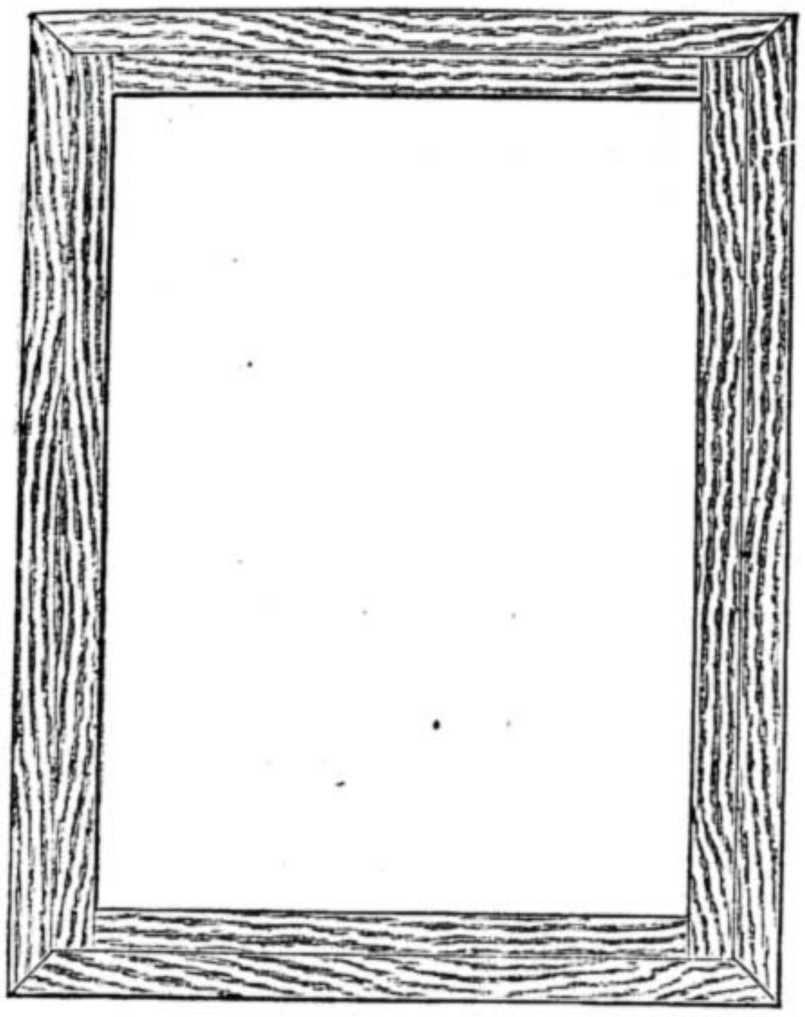

Fig. 5.

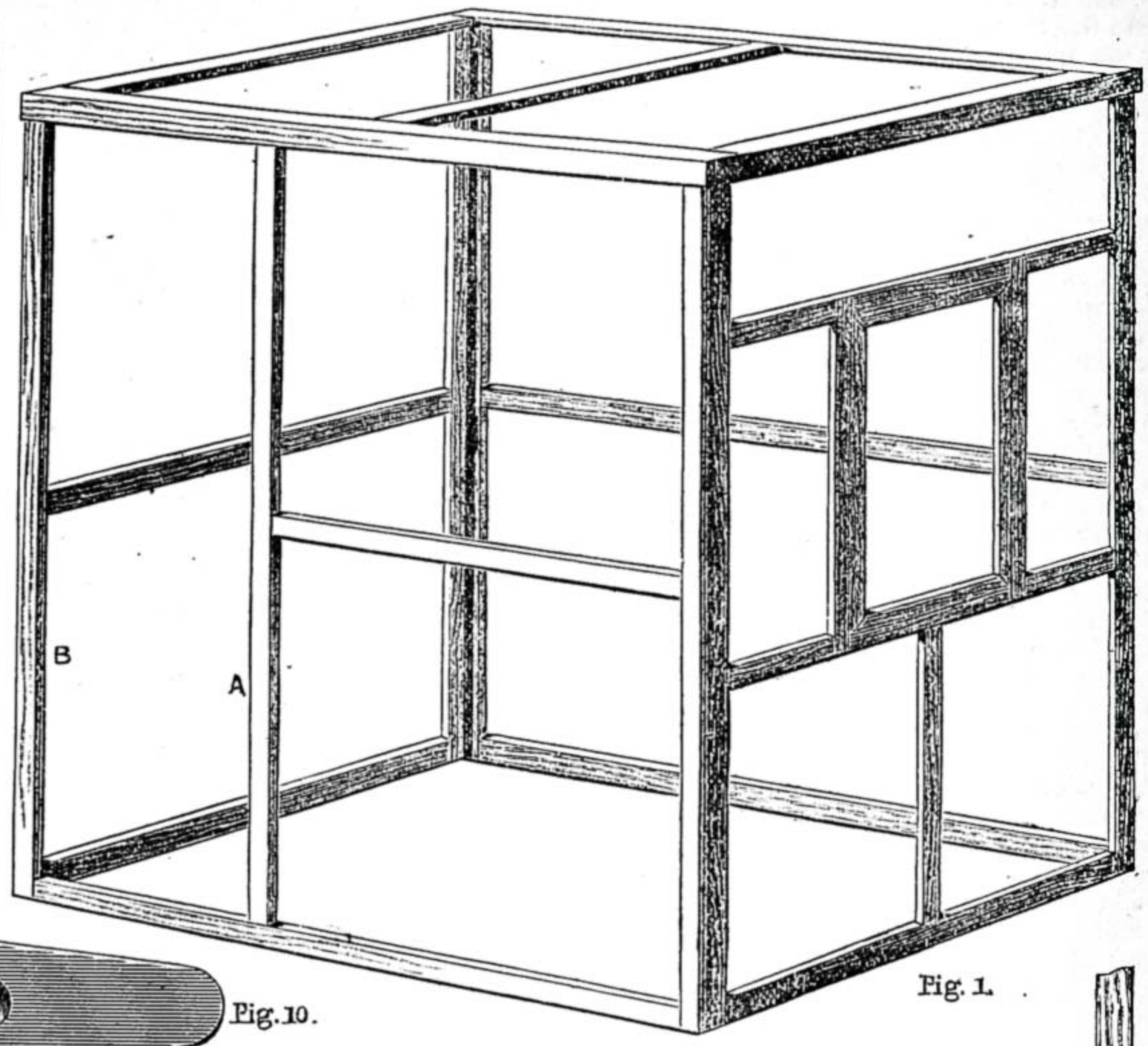

Fig. 1.

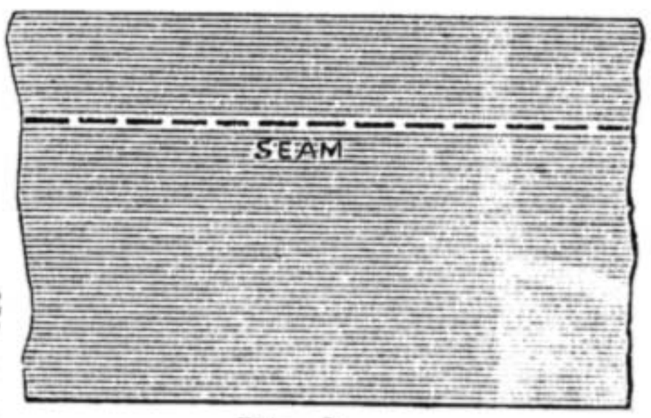

Fig. 8.

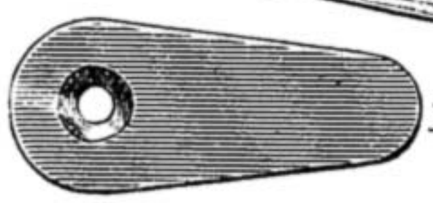

Fig. 10.

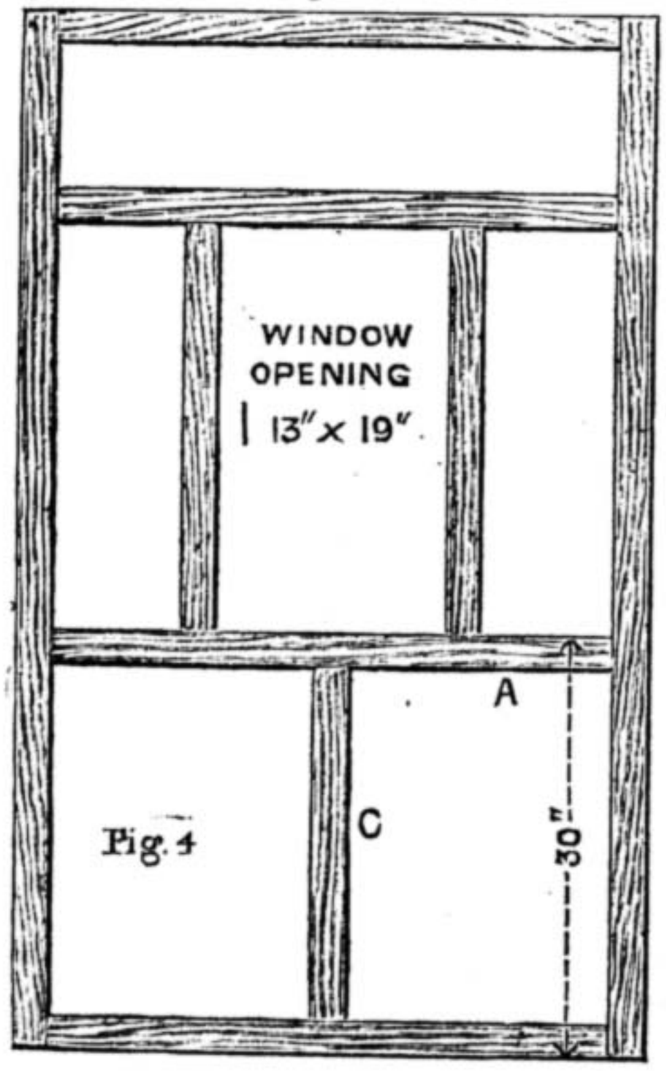

Fig. 4

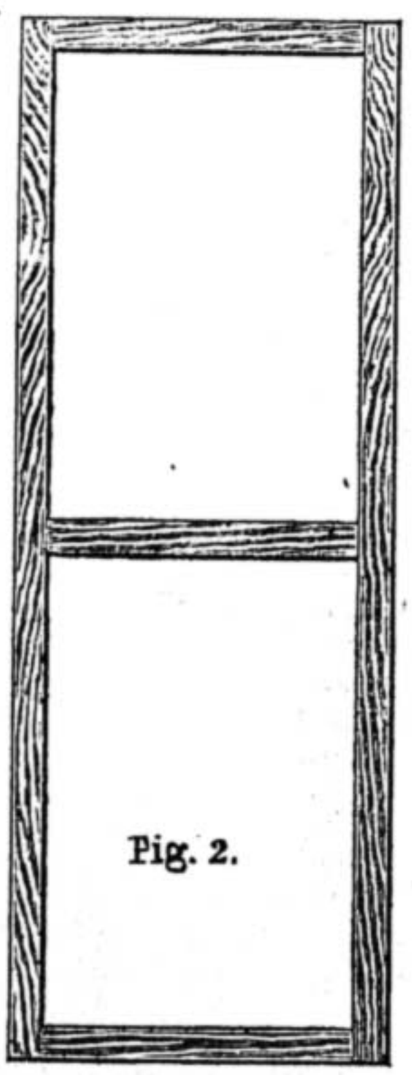

Fig. 2.

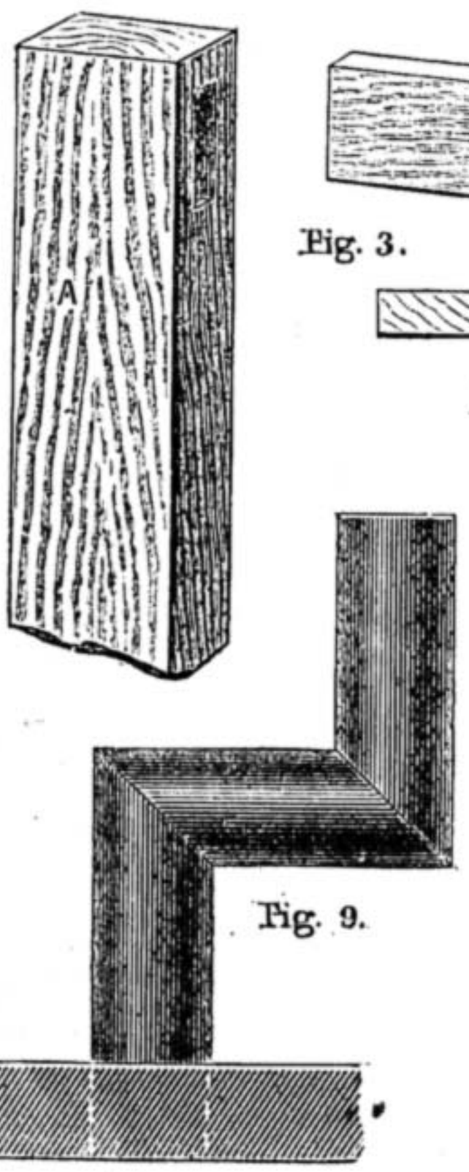

Fig. 9.

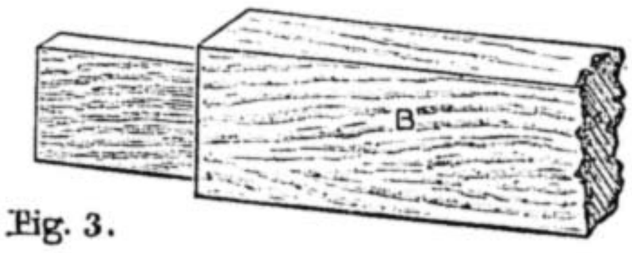

Fig. 3.

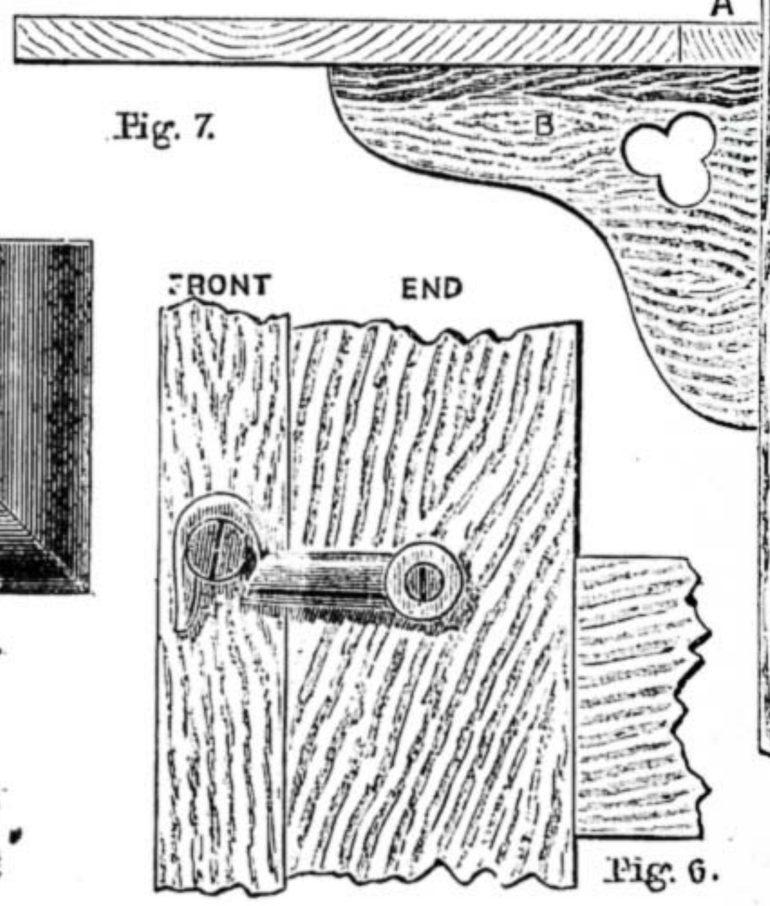

Fig. 7.

Fig. 6.

Fig. 1.—View of Framework without Covering in Isometrical Perspective. Fig. 2.—Door. Fig. 3.—Mortice and Tenon Joint. Fig. 4.—Window End. Fig. 5.—Frame for Window. Fig. 6.—Mode of hooking Frames together. Fig. 7.—Developing Table. Fig. 8.—Joining the Calico. Fig. 9.—Ventilating Tube. Fig. 10.—Turn-button for Window.

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in the construction of a dark-room is the ventilation. Fig. 9 is a tube of tin or zinc 2 in. diameter with two elbows. This tube is fixed in the centre of the rail in the roof frame.

This form of tube will effectually ventilate the room and keep out the light. Air must be also let in somewhere near the bottom of the room. In the window end cut a row of 1 in. holes, immediately above the ground rail on the outside, and through the outer covering only. For the inside, cut a row of 1 in. holes just below the rail under the opening for window. The air will thus be admitted, and all white light kept out, while the foul air will escape through the zinc tube above described. Now we have to make a frame for the window, as well as a check to receive it and hold it in place. This check is made of wood 1 in. broad and ¾ in. thick, and is mitred at the four corners, as shown in Fig. 5. When it is screwed on, about half an inch of the inner frame shows around the inside. This is to form a stop for the window frame. This frame is made to fit exactly into the check just described. It may be made of stuff 1½ in. broad and ¾ in. thick, and should have a rebate, or check, cut to receive a pane of common window glass. It is held in its place by four small turn-buttons, shown full size in Fig. 10. This window and its surrounding check is shown somewhat enlarged in Fig. 5. A similar frame is made to fit inside the same opening as the glass frame fits into. This frame is covered with one or two thicknesses of the yellow or ruby fabric sold by most photographic apparatus dealers at about one shilling per square yard. This frame is held in place by the same turn-buttons. By this means the room may be used with either red or white light according to the operations going on. A ruby lamp is usually a necessity in a dark-room when working by night. In this case it is unnecessary. All you have to do, if using this dark-room indoors, is to place a small bracket or shelf just below the window on the outside, and on this shelf place a candle or ordinary lamp. The light will show through the cloth frame, and serve all the purposes of a ruby lamp. Now as to the fitting up of a developing table. This is simply a folding-down board, and may be the whole length of the inside measurement of the room at the window end, or only part of that length. First of all, a fillet is firmly screwed to the rail that supports the window frames. This fillet is 1 in. thick and 2 in. broad. To this fillet is hinged the board or table of the same thickness, namely, 1 in. The developing table should be at least 12 in. broad. An end view of the table and fillet will be seen in Fig. 7. The hingeing is at A. The hinges may be either sunk into the edges of the fillet and table, or put on flat below. To support the table, a wooden bracket B is made and hinged to the upright post C, Fig. 4. This bracket is 1 in. thick, and folds under the fillet to which the table is hinged, allowing the latter to fold down when the room is out of use, or the outside being used as the background before described.

The only remaining operation required to complete the structure is the hooking together of the frames. For this purpose sixteen 2 in. window-shutter hooks and eyes must be procured. These hooks are fixed on to the vertical standards of the ends, four on each standard, and the eyes screwed into the edges of the front and back frames. Fig. 6 shows this. In the drawing, instead of an eye, a round-headed screw is shown, which is a very good plan. To ensure good light tight joints, strips of thick flannel, or other soft material, should be glued all round the edges of the ends, and also on the top and bottom edges of the front and back frames. It is a good plan to put two or three thicknesses of this material all round the bottom edges of the frames where they sit on the floor, so that the weight of the structure will keep the joint close. Inside the window frame and on the check for the door strips of flannel should also be glued. The dark-room is now complete, and should be put together to see if all is working right. If the amateur can without difficulty lead a water supply into the dark-room, the best plan is to fit a porcelain or zinc trough into the developing table, and lead in the water by a rubber tube through the roof, while the waste may be led out by another tube from the trough. This method is always handier than using a basin and jug. The putting together of the dark-room only occupies about two minutes, and very little space is taken up by the frames when put aside. The cost from beginning to end is very little, and the dark-room is far superior to any of the dark tents and other articles sold by photographic dealers, giving more freedom, air, and pleasure in the various operations connected with photography.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

75.—A New Form of Violin.

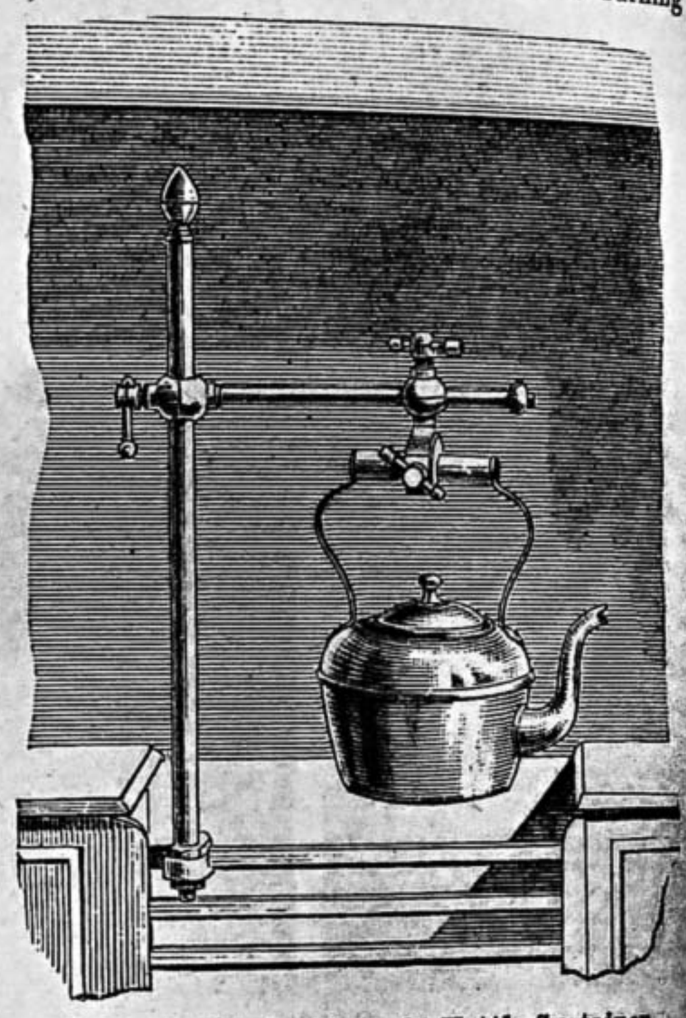
Mr. P. H. Ziedler, Musical Instrument Maker, 50, Bridge Road, Hammersmith, has sent for my inspection a new form of violin manufactured and supplied by himself. The peculiarity in the instrument consists in its having what he terms a "double arched belly," which has the appearance of an ordinary violin with a projecting overlay of wood in the centre of the belly extending as far as the *f* hole on either side, with a margin between the edge of the piece superimposed and the top and bottom of the fiddle. The general look of the violin is not so good as that of one of the ordinary form, as the raised piece on the belly gives a degree of clumsiness and solidity to it, but the tone of the instrument, as far as I dare venture to judge, seemed sweet, full, and powerful. The invention applies to all stringed instruments that are played with bows. Mr. Ziedler says that he was led to the invention by noticing the great rarity of good old violins and the desirability of constructing instruments in such a manner as to obtain in a new violin the quality of tone that is so much admired in the old instruments. He claims to have succeeded, and thinks that in the end his invention "will be recognised by all lovers of this most perfect of all musical instruments, the violin." He tells me that Mr. J. M. Fleming, author of "Old Violins," thus writes of a violin made on his new method:—"I have now had an opportunity of trying your violin. The tone is of a remarkably taking quality, very much freer than that of the high-class new violins of the present day." This opinion, coming from a writer and violinist who thoroughly understands the old instruments, is worth far more than anything I can say about Mr. Ziedler's invention.

76.—Photogravure.

This is the title of a comprehensive work on this subject written by Mr. W. T. Wilkinson, illustrated by Mr. W. L. Colls, and published at 1s. 6d. by Messrs. Iliffe & Son, 3, St. Bride St., E.C. The subject-matter of the book is divided into six chapters, dealing—after the introductory chapter on the six stages of the process of production, the printing press used, and the materials and appliances required—with the preparation of the negative, the carbon transparency, laying the ground, the carbon resist, and printing the plate. The frontispiece affords a good specimen of the results of the process in the reproduction of a river scene with boat, etc., beached on the strand.

77.—Telfer's Patent Victoria Kettle Sustainer.

The nature and purpose of the Patent Victoria Kettle Sustainer, invented by Mr. John Telfer, 73, Palermo View, Seacombe, may be gathered from the illustration of the contrivance given below. The object is to swing the kettle or any other cooking utensil that can be thus suspended over the fire at some little distance from the top of the grate and its burning



Telfer's Patent Victoria Kettle Sustainer.

contents. Of course there are more ways than one of managing this suspension as described in Mr. Telfer's Complete Specification, No. 7,610, A.D. 1889, but it will be sufficient to deal with that mode which is shown in the illustration. First of all there is an upright standard which is clamped to the top bar of the grate. A loose sleeve surrounds this standard for nearly the whole of its length, and on this sleeve a bush or boss slides up and down which can be clamped to the sleeve by a set screw at any required height, the sleeve then affording the means of motion or revolution about the standard. From the boss proceeds a horizontal bar, along which slides another boss also provided with a set screw for clamping, and the boss is filled below with a pair of jaws in which is grasped the handle of the kettle, etc., that it is desired to suspend over the fire. Thus the kettle can be swung immediately over that part of the fire where the glow and heat are greatest. It may be further made available for holding a cross bar with hooks dependent from it for roasting meat before the fire. How cooks might be disposed to regard Mr. Telfer's invention I cannot say, but it is manifestly only fitted for use on open grates, for it would be of little use on the hot plate of a close range. Mr. Telfer will exhibit a model in the forthcoming "Work" Exhibition of 1890-91, and would like to make terms with a respectable firm to manufacture the article, as he is confident there will be a great demand for it.

The Editor.

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SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

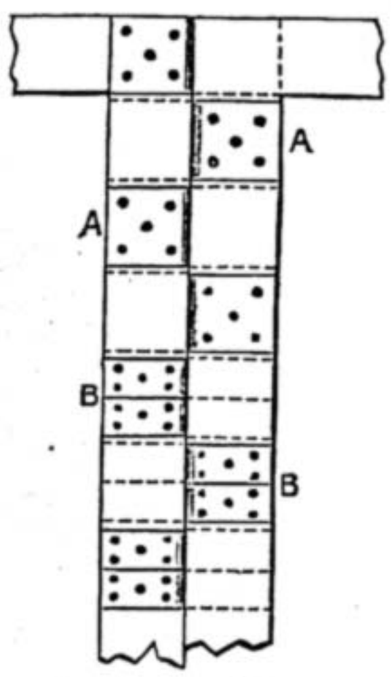
NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Continuous Hinge for Draught Screens.—W. M. (*Birmingham*) writes.—"Some years ago I made an excellent hinge for this purpose by adopting the same method as the old clothes horse; but, instead of a pair of webbings top and bottom, I made a continuous hinge. I used thin oil-cloth cut to, say, 3 in. or 4 in. wide, as at A. I began at the top, and tacked the first flush with top of top rail following on to the bottom, each strap *touching* the one above. It worked admirably, opened and closed either way, cost very little, and the joint was as draught proof as the rest of the screen, and this is a great point gained. These hinges should be nailed on before the screen is covered; the covering will then hide the tacks and make a neat, workmanlike job. This joint is so strong, that thick calico or black buckram would do instead of oil-cloth. Webbing would answer—put two together as at B—but wide strips are less trouble, take fewer tacks, and less time."



Continuous Hinge.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Violin Wood.—AMATEUR VIOLINIST.—The necessary materials for making a violin may be purchased from the firms named below. The size is that which is usually termed ¾ size:—G. Withers and Co., St. Martin's Lane, London; Henshaw and Loebell, Swan Street, Manchester; Briggs & Tarr, Commercial Street, Leeds.—B.

Address.—N. N. D. (*Leeds*).—The small dynamo mentioned by H. G. B. was supplied by Mr. Bottone, electrical engineer, Carshalton, Surrey. This address will find him.—G. E. B.

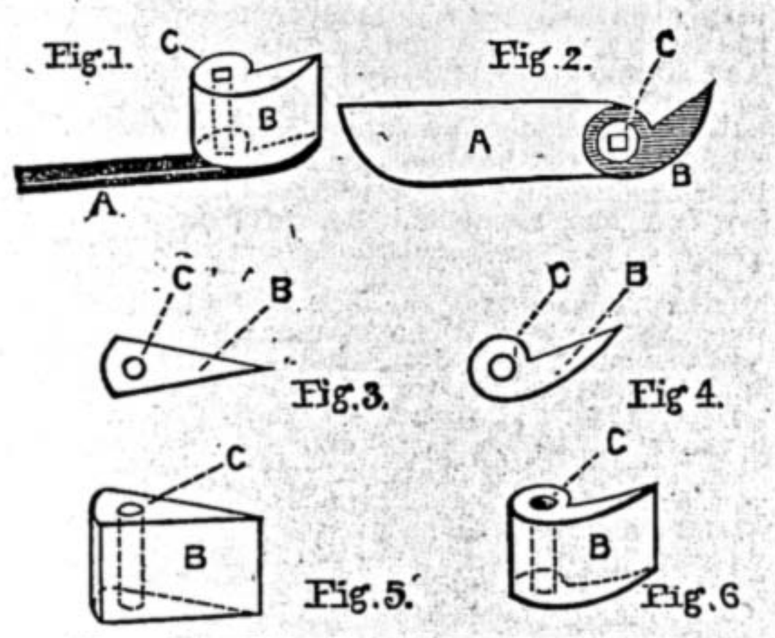
Electric Depilatory.—M. P. S. (*Kingstown*).—Write to Messrs. T. Gent & Co., Faraday Works, Braunstone Gate, Leicester, for their electro-medical apparatus catalogue, and enclose four stamps to defray cost. I suspect you omitted the stamps, and that is the reason you failed to get a reply. Some folks write to me sometimes and actually have the cheek to ask for a reply by post, but do not put in any stamps for postage. They expect me to make them a present of my brains and time, and pay them for accepting the present. Tradesmen are more keen in this matter than a poor author. The address given before was quite correct, but I suspect the stamps were missing.—G. E. B.

Electro-plating.—SUBSCRIBER.—The promise still holds good. Full instructions in electro-plating will be given in WORK when room can be found for the articles, and the captain of our ship sees fit to take them aboard.—G. E. B.

Cement for Lamp.—F. C. B. (*Battle*).—Presumably you ceased to look in "Shop" after finding your long-looked-for reply to query sent, for on the very day you wrote your letter there appeared the information you seek: viz., in No. 74, page 356, to which I refer you, though I expect you will have seen it in the meantime.—R. A.

Sheet Metal Book.—H. A. (*Birmingham*).—The best book on this subject is undoubtedly that by C. T. Millis, published by Spon, full particulars of which appeared in "Shop" of No. 73, page 340; the price is 9s., not 2s., as there stated. "Drawing for Metal-plate Workers," Cassell & Co., is also a very handy little book, with numerous plates, price 3s. With respect to Warn's book, no wonder you could not find the publisher of it; it is sold by his widow or relatives at 94, St. Augustine's Road, London, N., price 10s. 6d. There is frequently an advertisement in the *English Mechanic*, stating that a few copies are for sale cheap, slightly soiled; probably the demand for the book has greatly fallen off.—R. A.

Clock Matter.—LEO.—The action, size, position, and shape of gathering pallet are as follows:—Action: when the rack falls at the hour the gathering pallet picks it up again one tooth at a time. Size: enclosed drawings are full size. Position is on the long pivot or arbor of the wheel next above the pin wheel; in the English clock it is usually squared on, and in the French merely let on round. The English has a tail, A, which stops the striking when the rack is up, by resting against a pin in the end of it, the French being stopped by an arm pivoted between the plates. For shape, see Figs. 1 and 2. Same letters refer to same parts of all sketches. A, tail; B, body or hook; C, hole where pivot comes through. Fig. 1, top view; Fig. 2, side view. Locking plate striking wrong way may be caused by the arm that drops in locking plate being slightly bent, so that it catches one side of the notch or other, or by the inner part of the arm that catches in the wheel between the plates being worn, or not dropping far enough down to hold it; if the first, bend the hook part back or forward, as the case may be, till it falls fair and clear in the middle of the notch of locking plate; if the second is the cause, bend the outside arm up a little, which will allow the inside arm to go lower. *Clock striking too fast.*—Probably the



French and English Gathering Pallets.

fly is too loose on its pinion, and the train rushes without the fly; if so, strengthen or tighten the spring that grips the pinion deeper in the warning wheel. In French clocks the fly is pivoted in an eccentric bush on purpose to regulate the striking; put deeper to go slower, shallower to go faster; if not sufficient, put a higher number fly pinion to go quicker, lower number to go slower. Watches called horizontal are those that have a cylinder escapement—that is, the 'scape wheel is working directly on a cylindrical staff, so to speak, instead of on a separate pair of pallets, and thence to the staff and balance. *Mainspring gauge.*—The notches and numbers on the edges are the standard size or width of springs; the rings are for gauging the diameter of springs to suit the size of barrel. *Mainsprings.*—In the English watches the outer hook is usually riveted to end of spring. The Geneva only requires a hole in the end of spring, the hook being screwed in the barrel.—A. B. C.

Gold Blocking.—W. H. C. (*Birmingham*).—The lettering on the sample you send is done by printing like hat tips, with hot brass blocks having leaf gold or Dutch metal placed between. See my reply to G. McA. (*Liverpool*), page 192 of WORK, No. 64. Write for prices, etc., to G. Le Sage, gold blocker, etc., 10, Fore Street, City, E.C. As to fastening "Glacier" decorations on window glass, did you not inquire for directions for fixing when you bought them? Ask the person who sold them to you, or write direct to McCaw, Stevenson, & Orr (the patentees and manufacturers), the Linenhall Works, Belfast.—J. W. H.

Waterproofing Cloth.—J. R. (*Newton Stewart*).—The sample of cloth you enclose would not only be far above the powers of an amateur—without expensive plant—to produce, but would cost far more than it could be bought for. Write for samples and prices to any waterproof dealer, or to Charles Macintosh & Co., Cambridge Street, Manchester, who would also supply a reliable solution of indiarubber in naphtha, so that you could put the seams together yourself, as also fix the buttons, bind the button-holes, pocket-flaps, etc.—J. W. H.

Trapping Blackbirds, etc.—HOPEFUL wishes to know how to make a trap without having to use call birds. I advise HOPEFUL firstly that blackbirds and thrushes do not feed on the ground much; their food is chiefly the aphis, little insects, etc., to be found on large trees; it is, I believe, only at times, such as after showers of rain following dry weather, and "far from the busy haunts of men," that they come to ground for small worms, etc., or perhaps near the edges of some sedgy pool. If very hungry, one may see them pounce down upon the fleecy back of a sheep, just before shearing time, diligently hunting for "sheep-ticks," and that therefore bread as a bait would not be successful. Secondly, that unless HOPEFUL follows the old method he discards (and which is not very successful except in mating time), he might try "limeing." Bird lime can be purchased at any bird-fancier's shop, or can be made by chewing wheat in the mouth until it is thoroughly masticated into a sticky mass, keeping it as dry of saliva as it can be. Then having previously noted where his intended victims "most do congregate," watch for their temporary absence—early mornings, when they seek some brook or stream for their matutinal bath and their "early purl;" then lime the twigs and smear the boughs you have touched with aniseed, to ensure that you have left no scent behind you. All birds *love* aniseed; pigeons in the West Indies I have known to gorge till they burst on it, whilst growing. This mode will beat traps. In the winter, the old brick trap of one's school-days might be tried, but sparrows, linnets, wrens, robins, and chats, or yellow-hammers, are far more likely to be taken than blackbirds or thrushes, as such traps are too small for these latter. Most birds that are intended for caging are taken before they can fly from their parents' nest, as, not having learnt what freedom is, they do not as a rule pine from the effect of captivity, which old birds naturally are prone to do, and very frequently die before they become reconciled. Not only does one lose the fruits of one's labour, but one has sundry prickings of conscience when the trapped or limed bird refuses food and dies.—J. W. H.

Writing on Glass.—T. W. V. (*Leicester*).—To write on glass, or, as it is properly called, to etch, as the letters are *eaten out* by an acid, you require either liquid hydrofluoric acid or hydrofluoric acid gas, according to the effect you wish to produce; the former eats away the glass but leaves it clear, the latter gives the part operated on a ground glass appearance. For the first way, clean a piece of glass, warm it, rub over with white wax or bees-wax, and trace the letters with a needle or pen-knife, going quite down to the surface of the glass; make a wall of wax all round the edge of the glass, and pour on hydrofluoric acid, and leave for two or three hours, then clean with turpentine. To produce letters with a ground glass appearance, place in a leaden dish two parts of powdered fluoride of calcium, pour on three parts of sulphuric acid, and with a stick mix into a paste. Prepare the glass as before, except that there is no need for a wall of wax round the edges; cover the leaden vessel with this piece of glass, and by warming the vessel gas will be evolved, which will attack every clear part of the glass. Let me caution you to be very careful indeed in using the acid or the gas; the fumes, if breathed, are highly injurious, causing ulcers on the lungs, whilst drops of the acid on the skin act like a red-hot iron, and produce very painful sores, which are not easily healed. As regards your second question, opal can be heated as described above, and the letters coloured or enamelled afterwards, or you can use china colours, and have the opal fired. White letters on coloured glass may be obtained by using flashed glass, and treating with acid upon the flashed side, which is soon eaten through, leaving the plain glass underneath. An ink for writing upon glass is sold in gutta-percha bottles at 1s. 6d. per bottle (carriage, of course, extra) by Messrs. Townson & Mercer, 89, Bishopsgate Street Within, London, E.C.—W. E. D., JR.

Shellac.—HOPEFUL (*Newry*) has not complied with the Editor's rule as to asking separate queries on separate paper. I will excuse him this time, trusting that in future he and other correspondents will observe this rule, or their second queries will not be noticed.—(1) Shellac is the gum of a tree prepared chiefly in India and Ceylon; a sort of resin. (2) Procure the index of first volume of WORK, price 1d. You have as much time to look up past articles as I have. If your bookseller has not got it, send 1½d. in stamps to the publishing department, Cassell & Co., for it.—J. W. H.

Sign-writing.—J. S. (*no address*).—You should buy an index to Vol. I. of WORK, price 1d., from any bookseller, and then refer to the sign-writing articles. Ascertain the numbers of the pages referred to, and then obtain these of your bookseller, or of Messrs. Cassell & Co., London, E.C., direct.

Suction of Fan.—J. B. (*Glasgow*).—You may take it that if your fan is powerful enough to exhaust the four chambers, the distances of the valves will not practically affect the question. The area of the air passage to the fan must be in excess of the sum of the areas of all the valves when opened to their widest. The volume of current passing through the different chambers will vary as the openings of the valves, *if the inlets have openings in the same ratio.* The state of affairs is this: the fan sets up a certain amount of vacuum in the passage into which the valves open, and this vacuum will cause a flow of air at a certain velocity, and, therefore, while the vacuum remains unaltered, the quantity flowing through an aperture into such passage will vary as the size of the opening through which it flows, and the least of the two openings, the inlet and the valve, will determine the quantity passing through the chamber. To determine approximately the quantity of air flowing through an orifice in cubic feet per minute, multiply the area of the orifice in square feet by the square root of the vacuum in pounds per square inch, and by 13,428.—F. C.

Dulcimer Drawings.—J. W. D. (*Manchester*).—If J. W. D. will refer to Nos. 31, 38, and 41, Vol. I. of WORK, he will find a full description, with all necessary drawings and details, for the construction of a dulcimer. If, however, he should require any further information on the subject, and will write more fully, I shall be glad to help him in any way, to the best of my ability.—R. F.

Zither.—MUSICUS.—An article on the construction of this favourite instrument is in the hands of the Editor, and only awaits its turn to appear in the columns of WORK. Short paragraphs have from time to time appeared in "Shop," in reply to

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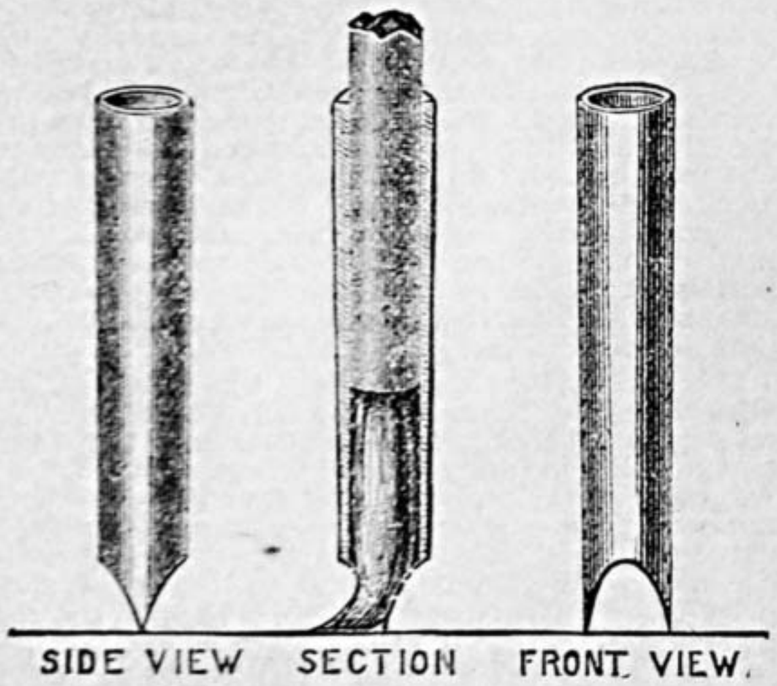
queries, but as these have appeared in Vol. II., it is difficult to give page and number without hunting the file through.—R. F.

Black for China Painting.—G. R. (*no address*).—G. R. pays me the compliment because I answered, as he says, a query at page 341, No. 73 of WORK, *re* "Litho Transfer Paper," of J. B. (*Tunstall*), to think I can also help him. He may be assured that I have all the will to do so, but I fear I do not possess the precise experience. The fact is, that every china and glass painter has usually his (or her) own pet recipes for mixing ceramic colours, and mere amateurs like myself (so far as ceramic art is concerned, I am but a tyro) can scarcely aid in a matter like this. I should, however, in G. R.'s place try to let down the black with "oil of tar." To thin it for flowing from a ruling pen seems to me, however, a little visionary. A fine brush, such as the china painters of Sèvres use, would be far more likely to give the body required. With a little practice a brush is as easily governed as a pen, and gives the power of far greater freedom. Ceramic artists in France, both at Sèvres and at Creil (near Chantilly), the one a "porcelaine," and the other a "faïence" establishment, use fine brushes made from the long, fine, taper hairs obtained from the inside of a cow's ear, which are far more springy, more gradually taper to the point, and more lasting in "oil of tar" than the best of sables. It was with one of these I was once honoured in being allowed to see Mademoiselle Robert, daughter of the director of the porcelain works at Sèvres, line in the fine veins of some pencilled geraniums she was introducing in a grand vase, some 175 centimètres in height (about 5 ft. 3 in.). No pen that was ever made could have excelled the delicacy her lithe fingers attained with the most consummate ease with this *cow-hair* brush. G. R. asks where to buy the best ceramic colours. Lechertier, Barbe & Cie., Regent Street, have a very high reputation in France, and, I believe, also in Germany; and if G. R. writes to them, no doubt they will be able to inform him how to use colours, with a pen, that I have only known to be used with a brush. For ruling border lines with a brush the following simple little expedient may serve the purpose of a ruling pen:—Cut a short



Quill cut for Brush-ruling.

quill so that it is open at both ends: *i.e.*, cut away all pith and feather and the closed end. Now a quill tapers at the point, so that you should make sure at what distance the diameter of your quill will be equal to the width of your intended line; at that point, taper your quill both sides until it is V shaped (see diagram); you can then slide a brush that just fits it into this quill; fill it with colour, and rule your line with one of the two V points against your straight-edge, and both in contact with the paper or glass, as the case may be. The quill should be regulated by slipping it higher up or lower down the quill of the brush itself. It forms a nice hard support against the ruler or straight-edge, whilst it confines the hairs of the brush exactly to the width, and prevents spreading. As quills can be obtained any size almost and brushes to fit each size, any line from $\frac{1}{64}$ in. (with a crow-quill) up to nearly $\frac{1}{2}$ in. (large swan) can be readily got. Small taper brass tubes will answer equally well, and would not cost very much; but the quills are the handiest. When done using, always wash out clean, both quill and brush, and save for future use. —J. W. H.

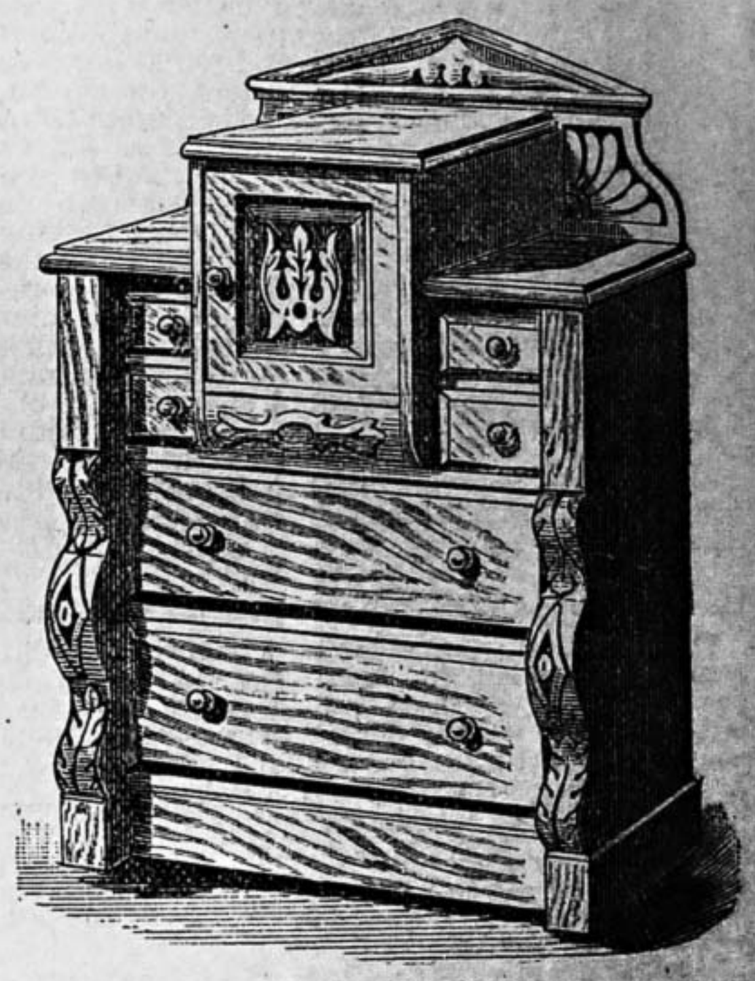
Lantern Lamp.—EXHIBITOR.—EXHIBITOR has purchased a lantern, a sketch of which he has sent. The lamp seems to be a kind of moderator which in some way fails to act, or, as he puts it, "the lamp, owing to some cause or other, won't burn properly." From the sketch I judge it is a French make, as I think I have seen some cheap lanterns lately very similar, which are French. As EXHIBITOR does not give the slightest clue as to what the fault is, it is quite impossible for me, or, I think, anyone, to help him. I must ask a few questions, and perhaps, if he answers them, some help will be forthcoming. In the first place, in what respect does it not "burn properly?" Does the oil fail? If it is, as he suggests, a moderator lamp, there will probably be a spring inside, acting against a kind of valve of leather. The leather has sometimes to be renewed. When the oil is forced up by the winding of a key, does the lamp act for a time, and then suddenly fail? Look at the lamp and see if there is provision made for winding. Again, what kind of oil is used? From a remark made in EXHIBITOR'S letter, I fancy he may be using paraffin oil, but this is useless for a moderator lamp. It must be whale oil or colza. Perhaps the difficulty arises from a badly prepared wick. Or it may be a fault of ventilation. But all this is working in the dark. My advice is, take the lamp to a lamp shop, and get it looked at by a competent man; it may be that the whole affair results from a little bad management. If it is a French make, the probability is that it is perfectly worthless. A lot of cheap and showy lanterns, as well as other things, are thrown into the market to catch the eye. In my judgment there is not a lantern made that comes any way near in quality an English-made lantern of the ordinary type, by a good maker. In saying this I have no interest whatever. England still keeps her place for good honest work, when a fair price is given, though, truth to tell, she can do a bit of scamping if the market requires it. In the present stage of the question I cannot offer any better answer. No reputable doctor will prescribe unless he sees the patient or knows the symptoms. The simple statement that "the lamp, owing to some cause or other, won't burn properly," can hardly be considered a valuable diagnosis.—O. B.

Small Metal Soldiers.—L. A. C. (*Wigan*).—The immense pressure on the "Shop" columns of WORK—which has compelled the proprietors to *give away* a four-page supplement about every six weeks to work off arrears—has crowded out my answer as to metal soldiers. Ere L. A. C. sees this, that reply may have appeared (to reply by post is against my Editor's rules). Parenthetically, I may remark that querists should not ask such questions as, for instance, "Can I make these myself?" How on earth can an expert, without ever having even heard of you before, say what you can or what you cannot do? If I were to assert your incapacity to perform any function whatever, you would be, of course, the first to tax me with prejudging your capabilities without just grounds! Is it not so?—J. W. H.

Picture-frame Making.—W. H. S. (*Nottingham*).—You must not forget practice helps to perfection. If you make your frame with the shooting block, you must be careful your angle is correct. I should advise you to get a truer; it is very easily made thus:—A piece of thin mahogany or oak; cut through it from corner to corner, then you have a correct angle; glue a slip of wood upon your square end, and lay it on your shooting-board ledge upon the side the plane runs, and you can always true it up and make up the deficiency with a piece of card at back or front of angle arm. That is the method adopted by frame makers. In joining slips, a piece of wood is made to fit on moving jaw of vice, so that the teeth or cross cuts do not mark your slips; screw your slips in gilt parts towards you, longest end in vice and shortest end in your left hand, gilt part to your body, mitre pointing to the ground; place it to your part in vice a little off correct fit, and bore hole for brad. Take it off, put brad in hole, and a touch of glue at back edge of mitre, so that it does not squeeze through in front; place them as before, and in knocking nail in you will at the last tap bring the mitre up to its proper level.—G. R.

Etching on Copper.—MONUMENT.—The best kind of etching ground is a matter of opinion; there are two famous makers: Sands' etching ground is 1s. per ball, and Rhind's liquid etching ground in stoppered bottles (quarter pound), price 2s. 9d. (carriage extra). To lay the ground in the old style, first procure a prepared copper plate (which may be bought at from 2s. 2d. to 3s. 6d. per pound weight), and clean with turpentine and whiting, cleaning the whiting off with bread. Wrap a ball of "ground" in new taffetas silk, of such a nature that small particles do not adhere. Fasten a hand-vice to the corner of the plate, inserting a piece of cardboard to prevent it from damaging the copper. Heat the plate over the gas (mind there is no dust) until a sufficient degree of heat is acquired to melt the ground through the silk and spread evenly over the plate. Next comes the "dabber," price 1s. and 2s. each. While the plate is hot, dab the ground all over with the dabber to spread it evenly, cleaning the dabber when it gets full on a piece of coarse canvas. If you have not ground enough, add a little from the ball and dab again. Next is the "smoking" of the plate. Get some two or three wax tapers and twist them together; light them and pass the flame rapidly along the surface of the plate, taking care not to burn the ground. The plate is now ready for the needle. The different light and dark shades are obtained by different processes, for a full explanation of which I refer you to a work which, before you go to any expense, I strongly advise you to procure and attentively read. It is entitled the "Etcher's Handbook," by Philip Gilbert Hamerton, Esq., third edition, Charles Roberson & Co., 99, Long Acre, London; 1881. As to machines, etching proper is all hand-work, except the biting. For information regarding ruling and routing machines, write to Messrs. G. Birch & Co., Islington Tool Works, Salford, Manchester. Space forbids my replying at greater length. Address another letter to the Editor concerning wood engraving.—N. M.

Chest of Drawers.—T. F. (*Wellington-on-Tyne*).—Enthusiasm such as yours merits admiration, but no certainty exists that your claims cannot be refuted. I will quote part of your letter, with the view of giving other readers an opportunity of determining the question. You say:—"As I had the honour of being the first to make the cabinet which was published in No. 1 of WORK, I respectfully beg also to claim the same honour for making the 5 ft. sideboard published in Nos. 24 and 25 of WORK; at least, I have not heard of anyone making it except a joiner in Newcastle." You must recollect, however, that many professionals and amateurs make articles from designs specially drawn for and published in WORK, but all do not trouble themselves to write and inform us of the fact as you have done in your case. Were they to do so, I am sure it would be interesting to publish particulars of their success for the encouragement of their brother readers. The point which deserves most consideration is not the length of time in which you completed your articles, but the soundness of the workmanship, which, I daresay, is satisfactory. To possess a cabinet and a sideboard made from the respective designs in WORK is something for you to be proud of, and I am sorry you are debarred, as you say you are, from placing one or both in the forthcoming "Work" Exhibition, by reason of the cost of carriage and chance of damage arising. I am looking forward with interest to this Exhibition, for it will be the means of proving the utility and pleasure afforded by WORK to the previously antagonistic classes of professional and amateur workmen, and also introduce several readers to each other. I would like to see your sideboard there, and so would the designer of it, no doubt, to whom I must say you "wish to pass a hearty vote of thanks." Your desire now is to make a chest of drawers. As you have made the articles just alluded to, you hardly require a sketch of an ordinary chest, therefore I have designed you something which



Chest of Drawers.

will, without much extra labour, be a considerable change to the old stereotyped patterns. It is astonishing how little attention designers have given to this class of furniture, for the different sorts could be numbered upon the fingers by only counting along them once. A cupboard is as useful as a drawer in some instances. Mr. Adamson's "Lessons from an Old Bureau," will give instruction to those desiring to make this chest, so I will say but little concerning it here. The cupboard projects beyond the main carcase the same distance as does the moulding of the two lower top boards, and the sides of it will be connected to the first long division of the chest proper. Between the bottom board of the cupboard and this divisional board will be a narrow space, which could either be left as such, fitted with a drawer, or, as I show, have a carved curved piece glued in front. The two sideboards will be of an ordinary thickness, faced up with long blocks or pilasters, between which will be carved brackets or halves of turned columns. The pediment, or, more properly speaking, the back, could be fitted on in a similar manner to that in which the sideboard back was secured. I have shown knobs, because I think these are more preferable to brass handles upon a chest of drawers. Carving here and there and bevelled drawer fronts will give a good effect. Let me know whether you like the design or not. Without being presumptuous, I shall live in hope of you passing "a vote of thanks" to me.—J. S.

Wet Process Photo.—F. C. (*Finsbury Square*).—There is nothing in the formula given to prevent success. The fault must lie in the use of the formula. You do not say how you have failed, so it is impossible to even guess what is wrong. The process requires learning. The best plan would be for you to see an expert go through with it, or carefully study a thoroughly good handbook on the subject. There is a very good one published by

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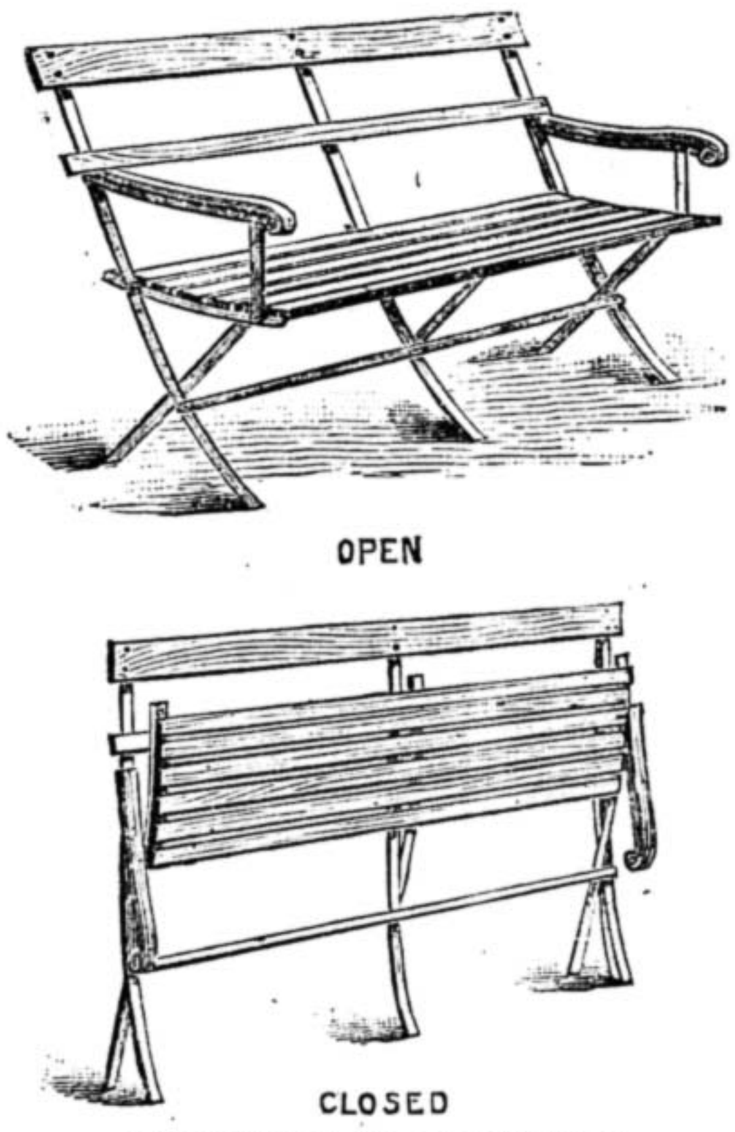
the Stereoscopic Company, but there are a great number on the subject by different authors available and reliable, but seeing the thing done would be very much the best plan in your case.—E. D.

Garden Seat.—W. R. S. (*Stratford*).—I am afraid that a folding garden chair to hold three persons, and made in the way you propose—viz., wood framing covered with carpeting—would scarcely be of a sufficiently strong nature to carry safely the weight put upon it. If, however, you will look up page 96, No. 58, Vol. II. of WORK, you will find a sketch and instructions for making a single folding chair, which, by widening and increasing the width and thickness of the wood framing a little, you may adapt to suit your purpose, although if I were about to make such a seat as you require, I should endeavour to construct the framework of iron, or get a smith to do so for you if you are unable to do it yourself. There is a very compact garden seat which is made to fold, and which holds two persons, made by the Clipsham



Garden Seat—Open and Closed.

Chair Co., of Tue Brook, Liverpool; perhaps if you wrote to the Company they would supply you with the iron work, and you could either make the seat of carpeting or of wood splines, as you found suit you best. I give you sketches of this seat open and closed, so that you may judge for yourself of its handiness for the purpose for which you require it, and should certainly advise you to adopt the iron framing, as it is much preferable to any wooden one you can make.—G. LE B.

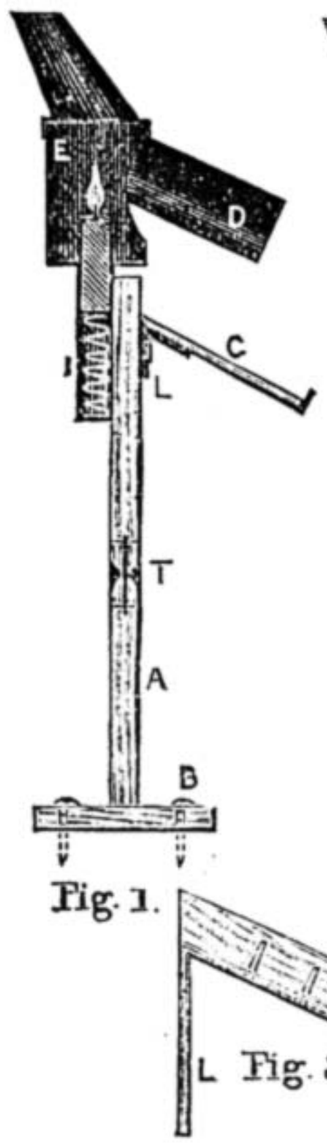
Sheet Brass.—PRACTICAL.—I am sorry for your disappointment, but your first communication did not reach me. Messrs. Tucker & Sons, York Street, Sheffield, will supply you, wholesale or retail, any description of sheet brass you may require in standard length, breadth, and gauge; extraordinary descriptions of brass will require a special order. Your second query as to a polish for brass is so ably answered and illustrated on page 324, Vol. II. of WORK, that I need say nothing. See also "Our Guide to Good Things," page 338, Vol. II., by the Editor. The third question is out of my way altogether. Correspondents should write their queries on separate sheets of paper when the subjects are wide apart: it saves time, trouble, and disappointment.—N. M.

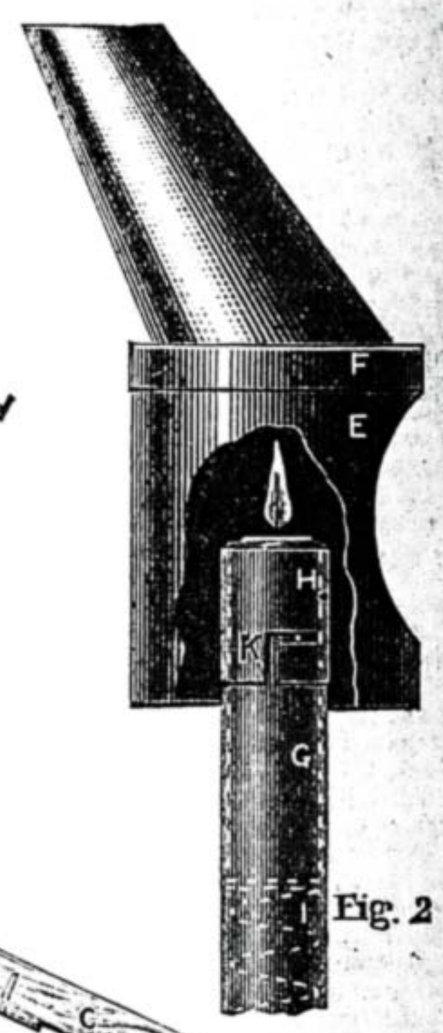
Polishing Marble.—P. McJ. (*Edinburgh*).—This must be done by rubbing with putty powder and water, applied on thick felt stretched over a block of wood. Of course the surface has first to be gritted down with grit, water, and a flat stone, and then made smooth with fine sand and water in the same manner. All the materials, including the felt, which is sold by the pound, are supplied by the marble merchant.—M. M.

Dynamo and Magneto-electric Machines.—E. D. (*Birmingham*).—If I understand your letter aright, you have made a magneto-electric machine which you wish to furnish current and give shocks. You wish to use it as a dynamo and shocking machine combined. To this end you have slightly altered the usual arrangements of such machines, and have put on a two-part commutator as for a Siemens H armature. This does not in itself spoil the machine if you have fixed the commutator in the right position, insulated its ring from the spindle, and its two parts from each other, divided the ring in a proper manner with an oblique slit in the right position, and fixed the brushes at the right angle to take off current when the bobbins cut the lines of magnetic force. I suspect, however, that you have not insulated your brushes from the other parts of the machine by placing them on insulating blocks of ebonite. You must do this if you wish to take off current from the machine. But, in any case, you will not get much current from such a machine, and the shocks will not be very sharp from No. 24 wire. Respecting the small dynamo you made twelve months ago, which you can work as a motor but not as a dynamo, I suspect you have not only reversed the magnetism of its fields by using it as a motor, but have also got the brushes fixed in the wrong position, or the commutator fixed wrongly. You do not say whether you have connected the field magnet coils to the brushes in shunt or in series. This is most important in your machine, which should work fairly well as a shunt machine, with the ends of the F.M. coils connected to the brushes, and wires leading from these to the terminals of the machine. If connected in series, *i.e.*, with one end of the F.M. coils connected to one terminal, and the other end to one brush, you will get very little current from the machine. If connected in shunt and driven at the rate of 3,000 revolutions per minute, it should light up one 2½ c.p. 6-volt incandescent lamp. Connect the coils in shunt, see that the commutator is fixed right as directed above, and the brushes insulated, then try the machine again. If you cannot get it to go right let me know, and I will try to arrange with you to see the machines.—G. E. B.

Copying Busts in Electrotype.—D. G. (*Moorfields, E.C.*).—Many thanks for your kind interesting letter. I will try to give concise replies to the several points raised therein. (1) *Battery.*—Daniell cells are far more constant than Bunsen cells for long runs of over ten hours, the extreme limit of a Bunsen's run on one charge. Bunsen cells are used by gold and silver platers, but not generally by electrotypers. (2) As plaster casts vary in porosity, I cannot say that one coat of boiled oil would be sufficient. The pores must be filled up to prevent absorption of the hot liquid composition, and it may take more than one coat to do this. (3) I have not tried gelatine as a substitute for the elastic composition, but think it would not be so elastic or durable. If you try it, let us know the result. An ordinary galvanised iron pail is a convenient vessel for turning out the cooled composition surrounding the bust. The composition may be melted again when required. (4) *Wax.*—Beeswax of the best quality should be used, so as to get a fine impression from the elastic mould. Harder material, requiring more heat to melt it, would also melt and distort the elastic mould. When the wax is quite cold it will be hard enough to polish with blacklead. (5) The very best blacklead of the finest grain must be employed and used dry on a very soft brush. It must not be mixed with water, but brushed on dry, using scarcely any pressure on the brush. (6) When about to pour in the molten wax, suspend a lead weight in the centre of the mould. This will be enclosed in the wax and act as a weight to keep it in the solution. (7) When the wax is melted out, and the interior oiled and dried, there will be still enough oil left to prevent perfect union of the two coppers. (8) If the metal surface is first warmed, and more than one coat of varnish is applied, I do not think you will be troubled with nodules of copper forming on the varnished surface. These are due to pin-holes in the varnish. I shall be glad to be of any further help to you in the study of this interesting subject.—G. E. B.

Reading Lamp for Magic Lantern.—C. M. (*Perth*) asks if the book on lanterns, mentioned in No. 63, is a book to show how to work the lantern to the best advantage. I am sorry I cannot give any information on the subject; but seeing it is only a shilling work, no one need be in doubt long on the matter. If it does not answer C. M.'s purpose it will not be a great loss in the pursuit of knowledge. His next question is one with which I think I can help him more successfully; for seeing, as he says, he has made a good lantern—on which I congratulate him—I am sure he will find the construction of a lamp not one of great difficulty, and one that, when completed, will meet his need. The drawings will, I think, almost explain themselves. Fig. 1 is a section of the lamp and stand. A is a rod of mahogany 1¼ in. square morticed into a foot. At T it may be cut in two and joined with a toggle joint, which will render it more convenient for carriage. To form the joint, make a saw cut in each half to take a strip of brass; if a pin is riveted in each length the stand can be folded, care being taken that the ends of the stand are rounded off in the direction of the joint. A square ferrule will be needed to slip over the joint, which then will be perfectly rigid. At L a staple must be placed to receive the end of the bracket carrying the reading desk. Fig. 2 shows on a larger scale the lamp. You will see the idea is taken from a carriage lamp. First decide what size candle will best suit your purpose, and work from that. Make a tin tube to admit the candle easily, and about one third longer; the lower end is closed. K is a short collar to fit on the tube, and may be about two inches long. Fit it on a round piece of wood so as to project, say, ¼ in. beyond it. With a hammer knock the end over, so as to reduce the size of the opening—with care it can be done very neatly. Cut a slot as shown at K. Place the collar in the tube and mark where the longitudinal slot is and solder a short pin to the candle tube: this will form a bayonet joint. With stout brass wire make a spring, as shown at I; this, when expanded, must be as long as the tube; a small disc must be soldered to its upper end to bear against the candle. For the body of the lamp we must make a large tube 6 in. in diameter and 6 in. long; one end must be closed with a disc with a central opening to take the candle tube, to which it must be securely soldered. One side must be cut away as shown. A chimney must be fixed to permit ventilation, yet so as to prevent the light escaping. A sheet of tin plate about, say, 8 in. square must be bent to a semicircle. One end must be hollowed out so as to allow it to pass partly round the lamp; it can be held in position by a couple of small hooks. This forms a reflector, as shown at D, Fig. 1. The desk C may be 8 in. square and ½ in. thick. Bend a strip of stout brass, as L, and screw it to the under side of the desk; the other part fits into a staple screwed to the stand as shown. Through the foot of the stand two screws are shown; these are to secure it, if need be, to the floor. To use the lamp remove F, take off H, force the candle into the tube, replace the cap H and the chimney, fix the reflector and desk, and we are ready to commence. The candle tube can be fixed to the stand by two staples. The height of the stand must be regulated by the height of the reader; it can be adjusted to some little extent by placing the candle tube higher or lower





Lamp and Desk for Lantern Reading. Fig. 1.—View of Lamp in Section—T indicates a Joint. Fig. 2.—Enlarged View of the Lamp, with body partly removed to show the Candle Tube. Fig. 3.—Desk.

on the stand. I trust these hints will enable C. M. to construct a very serviceable lamp and desk. It can easily be modified to fix on a table without the stand, though sometimes a stand will be indispensable. Should the arrangement with the candle be considered too much trouble to make, then a small lamp might be substituted, though the plan given is certainly the more portable and less messy.—O. B.

Small Dynamo Castings.—A. M. (*London, W.C.*).—Small dynamo castings are supplied to amateurs by Mr. S. R. Bottone, Carshalton, Surrey; Mr. H. Jones, 14, High Street, Lambeth; and Mr. A. Crofts, electrical engineer, Dover.—G. E. B.

Zinco Blocks.—ELECTRO.—I refer my correspondent to my previous replies to J. W. S. (*Sheffield*), No. 51 of WORK, page 813; to F. J. T. (*Bristol*), No. 58, page 92; and to INQUIRER (*Portland, U.S.A.*), No. 65, page 208; and again recommend Josef Bock's book on the subject (Wyman's "Technical Series," 2s. 6d.), of any bookseller, or 65, Chancery Lane, E.C. "Shop" is too crowded to repeat.—J. W. H.

Buying Second-hand Lathe.—H. P. (*Didsbury*).—You can watch the advertisements in the *Exchange and Mart* till you see a lathe you think would suit you, which is not too far off to go and see; or get an exact description of it; or get a friend to go and see it for you. The Editor holds the purchase money till you say you are satisfied; if the lathe were not as described, you would return it and have the money back. This I think the best way, especially if you are able to judge whether the lathe is a good one, or have a friend who can do so. Another way would be to inquire of local ironmongers or dealers in machinery; or, again, put an advertisement in a local paper; thus the lathe would be near enough for you to go and see. Take your time and watch till you find what you want, and you will thus get it at two-thirds to one-third of first cost, according to condition.—F. A. M.

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Dead Black for Brass.—W. M. (*Shepherd's Bush*).—Perhaps the following recipes will suit your purpose: three pounds of black sealing wax, and one pound of shellac, to one gallon of spirits of wine; or mix fine lamp-black with brown hard varnish or lacquer; this latter recipe is used for the interior of telescope tubes, the lamp-black serving to deaden the bright colour of the former recipe. Another black varnish for metal may be made by fusing three pounds of asphaltum and half a pound of shellac, and adding one gallon of spirits of turpentine. In applying, use soft, clean brushes, and be careful that no dust is flying about. Let the first coat dry hard before applying the second coat, and have the temperature of the room about 72°, especially for spirit varnishing. Spirit varnish requires between two and three hours between coats. Turpentine varnish between six and eight hours between coats. Oil varnishes about twenty-four hours between coats, according to the state of the atmosphere. For bright work before applying the last coat, smooth down with finest glass-paper. Cylinders and flat circular surfaces may be blacked in the lathe. Any further particulars on this subject will be found in Holtzapffel's "Mechanical Manipulation," Vol. III., in a long and instructive chapter on varnishing, lacquering, japanning, and bronzing, etc. With regard to the query as to the dead blacking of the interior of photographic dark slides, I much regret that I am not an expert; but, in the absence of a better formula, you might try the dead black recipe above.—N. M.

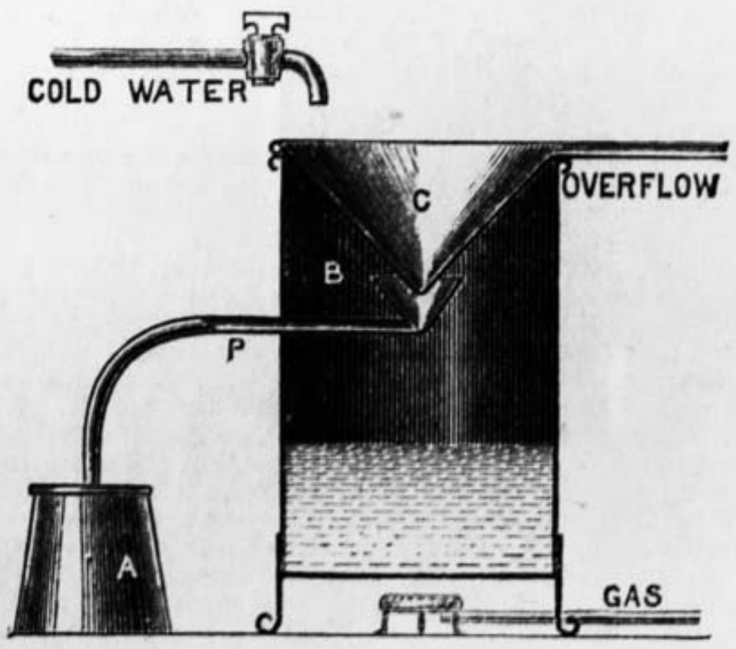
Jug Mending, etc.—E. J. S. (*Maidstone*).—It is a great pleasure to receive such letters as yours, and to know that articles which we have written, in the hope that someone may be helped and benefited, have been of service. I commend you for learning all you can; but, remember, more can be got by practice than by reading, and that to an observant man his failures are turned to service, and help to lead him on to success. As regards mending a jug with a broken handle, you will find that sometimes the only way to make a good job of it is to drill a hole through the side of the jug, and carry the rivet through, and solder it on the inside so that it cannot come out, filling the hole with plaster of Paris in the usual way; but of course this can only be resorted to in some cases. As you say, use "common sense;" and, I may add, plenty of it. In most cases the ordinary rivet into the side of the jug and the handle will be sufficient, if the rivet is put in the right place—*i.e.*, where the greatest strain is met by the turned ends of the rivet; in fact, when you come to perform the work, I think you will be surprised how strong it is if it has been done carefully. With the handle in two or three pieces, it is a great advantage sometimes to drill holes in the ends, and put a straight piece of wire in embedded in cement before riveting outside in the ordinary way. I feel certain that with a little practice you will do it well enough to charge for your work; your wish to better your position does you great credit, and if what little I have done has helped you, I shall be amply repaid. As to charges, you reckon according to the number of rivets you have put into the work, 3d. per rivet being the general charge in the trade, and this, as you will see, allows you a fair profit for your time and expenditure. The suggestions as to the arrangement of "Shop" must be for the Editor to decide; but what might suit one would not, perhaps, please another; personally, I should not consider it such an improvement as would compensate for the extra trouble. Shall be glad to hear at any time how you are succeeding, and if you get into any muddle will try our best to put you straight; it is such as you we want to help.—W. E. D., JR.

Tuning Organ-pipes.—J. H. (*Burton*).—Ordinary metal flue pipes are tuned with a metal, or boxwood, cone which is shaped much like a candle extinguisher. If placed over the top of a pipe (as though extinguishing a candle) and pressed down with a screwing motion it closes in the top of the pipe a little, and causes it to sound flatter. If the point of the cone is inserted *inside* the pipe and pressed down in a similar manner it enlarges the top of the pipe, and causes it to sound sharper or higher in pitch. Square wooden pipes are generally tuned by a lid of zinc, which covers the tops of the pipes; raising the lid sharpens the tone, shutting the lid downwards lowers the tone. Stopped pipes are tuned by means of the stopper or tompion; raising it *flattens*, and lowering it sharpens the tone. Some open pipes are tuned by a tube sliding over the body of the pipe at the top; raising the tube flattens, and lowering it sharpens the tone. Some again are tuned by means of long ears at the side of the mouth; pressing them inwards flattens, and pressing them outwards sharpens the tone. These are a few of the many ways by which the pitch-tones of the pipes can be regulated, and will, I think, be sufficient to indicate the general principles by which you must be guided in tuning.—M. W.

Bicycle Spring.—J. S. (*Crieff*).—With regard to the spring frame idea of our correspondent, it is not by any means new. There are numerous spring devices applied to the frames of safeties with the object of lessening vibration. From J. S.'s sketch, I should say it is almost identical with the "Weston" spring frame. I am not aware whether Mr. Weston has a patent for his frame. At any rate, J. S. will see that his idea is forestalled.—A. S. P.

Lincrusta Decoration.—A. R. B. (*Dublin*).—Lincrusta decorations cannot be produced except by the manufacturers. Expensive machinery and workshops are indispensable for its manufacture. The material is made in a variety of ways. One kind resembles carved wood, and is known as "wood effect;" this answers for door panels, dados, mantelpieces, etc. Another kind represents embossed metals, and is something like the highly raised Japanese wall papers; this goes by the name of "lacquer effect." The simplest sort is like rough-grained thick brown paper. There are two or three qualities of the latter—coarser and finer. These are employed as grounds by artists who paint subjects upon them in oil colours. They are used for friezes, screen panels, and so on, but cannot be much recommended, as the surface absorbs the colours greatly, and is not pleasant to work on. The one advantage is that subjects done on lincrusta need have no background, therefore such decorations are more quickly accomplished than those executed on canvas.—C.

Mint Still.—DISTIL.—I send you a sketch and particulars of a small still that may suit you, at the same time warning you to be very careful how and what you distil, or you will have the Excise on you like the proverbial thousand of bricks. The sketch is taken from one of Vevers' portable distilleries; they are sold at 6s. 6d. each, by C. C. Vevers, Briggate, Leeds. It consists of a round vessel or boiler on three legs, in which is placed the liquid you wish to distil. Heat is applied underneath by means of a gas stove, the steam condenses on the sides of the



Mint Still. A, Receiving Vessel for the distilled Liquor. B, Boiler containing Liquid to be distilled. C, Condensing Vessel. P, Conducting Pipe.

funnel C, which is kept cold by a constant supply of cold water; the condensed liquid runs down the sides of the funnel, and drops into the small funnel at the end of the conducting pipe P, through which it is led to the container or receiver A. This is a brief description, but I think you will easily grasp the idea, and if you want any detailed information as to how to make it, write again and I will gladly help you.—R. A.

Boot Last Iron.—COMPO-SNOBO.—I do not know where you could procure such an article. I have never seen one, but I should recommend you to make one of wood, as you seem rather ingenious. Wood would not be so cold as iron, and would answer all the purposes as well. But for myself I use a stump of wood 3 in. by 4 in, and 24 in. long, with a hole in top for the iron foot to go into. This rests on the ground and I hold it between my knees. It certainly makes a noise on a boarded floor which the other would not. Some people use a vice for holding the iron foot.—J. M.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. E. T. (*Birmingham*); LEROY; L. G. (*Bethnal Green*); A. C. (*Peterboro'*); C. E. D. (*Bradford*); J. W. D. (*United States, America*); G. E. W. (*Sowerby Bridge*); E. P. (*Castleford*); H. H. W. (*Blackheath*); F. A. C. (*Bristol*); J. D. (*Glasgow*); J. H. B. (*Manchester*); CLEAN; J. S. H. (*Stockton-on-Tees*); NORTHERNER; HYDRO; W. W. (*Chelsea*); F. R. H. (*Manchester*); S. H. M. (*Liverpool*); J. S. B. (*Devon*); J. W. (*London, E.C.*); G. E. G. (*Battersea*); J. S. (*Regent's Park*); J. F. W. (*Sunderland*); W. M. (*Southampton*); J. M. (*Edinburgh*); W. D. S. (*Redcar*); J. A. C. (*Essex*); DEAN FREST; F. J. C. (*Bristol*); J. E. S. (*Tamworth*); H. S. (*London, S.E.*); T. C. (*Durham*); WELL-WISHER; E. B. (*Brockley*); T. F. (*Acklington*); T. R. (*Paisley*); E. M. (*Camberwell*); J. K. (*Willesden*); G. F. G. (*Frome*); G. F. B. (*London*); W. R. S. (*Walton-on-the-Naze*); J. S. G. (*Lancashire*); J. P. (*Manchester*); A. T. S. (*New Swindon*); F. C. (*Leytonstone*); W. T. (*Tunbridge Wells*); M. P. B. (*London, E.C.*); F. C. (*Londonderry*); B. A. K. (*Sunderland*); F. J. M. (*London, S.E.*); H. S. (*London, S.E.*); T. C. (*Durham*); T. H. O. (*Dalston*); WORKER BEE; J. B. (*Brigg*); W. T. (*Exeter*); C. C. E. (*Lincoln*); F. H. (*Nottingham*); HOUSE PAINTER; A. V. (*Northampton*); C. H. G. (*Coventry*); S. J. S. (*Acton*); A. W. S. (*London, W.*); RAD (*London, S.E.*); A. R. (*Scorrier Saw Mills*); H. E. (*Brighton*); CONSTANT READER; H. J. E. B. (*Saffron Walden*); F. M. (*Kent*); W. D. G. (*Manchester*); TUNER; W. E. J. (*Wilts*); F. C. J. (*Masborough*); E. (*Carnforth*); E. G. (*Battersea*); W. H. W. (*London, N.*); W. E. G. (*Surrey*); J. T. (*Kensal*); H. B. (*Harrow*); A. M. (*Sheffield*); OLD BRUN; CYCLIST; G. E. (*York*); W. M. (*Salop*); H. B. (*Manchester*); R. J. C. (*Doncaster*); REGULAR READER; CONCAVE; T. B. (*Sheffield*); COUPLER; S. (*Surrey*); R. W. (*Hartlepool*); NAUTICUS; W. J. M. (*Canonbury*); C. F. H. (*Belfast*); E. P. (*Castleford*); B. (*Devon*); H. K. (*Clapham*); J. E. J. (*Huddersfield*); JUNIOR DRAUGHTSMAN; J. L. & Co. (*Birmingham*); E. J. B. (*Kentish Town*); P. M. (*Hoxton*); FOOCHOW ENAMEL; W. A. S. (*Clapham, S.W.*); E. T. (*Dudley*); S. D. (*Clerkenwell*); A. E. S. (*Islington, N.*); S. G. (*Suffolk*); F. E. B. (*Devon*); A. G. (*Plaistow*); H. B. S. (*Liverpool*); D. W. (*Edinburgh*); R. A. C. (*Clerkenwell*); FENDER MAKER; MACK; J. G. B. (*Stratford, E.*); H. S. (*Walworth, S.E.*); P. A. D. (*Canonbury, N.*); W. H. (*London, N.W.*); F W. (*Birmingham*).

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WORK

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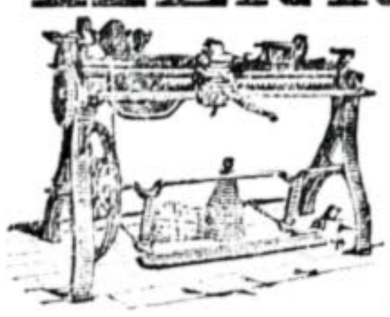

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